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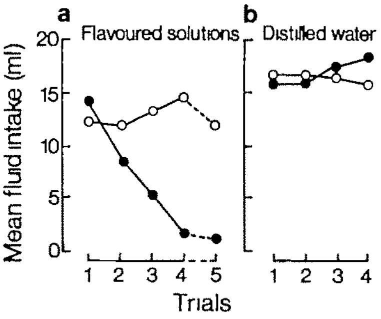

Figure 1 Aversive conditioning with dexamphetamine (1.0 mg/kg) in rats ($n=8$) (a) The mean consumption in 15 min of flavoured solutions paired with dexamphetamine (1.0 mg/kg i.p.) fell progressively (●, $P<0.001$), whereas the consumption of the control flavour was relatively constant (○). (b) There was a small but significant ($P<0.001$) compensatory increase in the mean 15 min water intake on the days after drug administrations (●), as compared with the days after intraperitoneal saline (○) The vertical bars indicate s.e. mean

Solutions with synthetic 'chicken' and 'lemon' flavours were modified from Lovett & Booth (1970). After rats were adapted to restricted access to water, a flavour was presented for 15 min on every second day. Immediately afterwards, either dexamphetamine sulphate or saline was injected intraperitoneally. Thus, for half of the rats in an experiment, 'chicken' was repeatedly paired with dexamphetamine and 'lemon' with saline, and *vice versa* for the remaining rats. Water was available for restricted periods between flavour presentations.

The conditioning of flavour aversion with dexamphetamine (1.0 mg/kg) is shown in Figure 1 (trials 1–4). The aversion, which was confirmed when both flavours were presented simultaneously (trial 5), was not affected by delaying injections until 45 min after flavour presentations, or by providing spatial as well as flavour cues. Lower doses of dexamphetamine (0.10–0.32 mg/kg) yielded weaker aversions, but even smaller doses (0.025–0.05 mg/kg) did not enhance flavour intake. Severe deprivation combined with highly palatable flavours may have precluded any further enhancement by the drug. However, manipulations of palatability and deprivation also failed to reveal enhanced intake. The apparent aversive property of dexamphetamine has therefore proved robust to several variations in procedure and it appears to date that neither the dose level nor a 'ceiling' effect can account for the absence of a positive reinforcing action in this type of experiment.

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Actions and interactions of morphine and dopamine on single neurones in the rat caudate nucleus

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Acetylcholine, 5-hydroxytryptamine, noradrenaline and dopamine have all been implicated in both the acute and chronic effects of morphine, but it is not at all certain which, if any, of these neurotransmitters in brain is involved in the central actions of the drug. However, dopamine is of special interest as binding studies have shown that some areas with high opiate-binding capacity (Pert & Snyder, 1973, 1975) also contain a high proportion of dopamine-sensitive neurones, e.g. the striatum, and this structure also contains relatively high levels of the endogenous morphine-like substance, enkephalin (Hughes, 1975). We have therefore used the microiontophoretic technique to study the effects of morphine on single neurones in the caudate nucleus of the rat and to compare its action to those of dopamine, applied to the same neurone.

Male Sprague-Dawley rats (150–300 g), anaesthetized with urethane (1.2–1.5 g/kg), were used. Five-barrelled micro-electrodes, with an additional single recording barrel attached, the tip of which extended 15 μ beyond the tips of the drug-containing barrels (Crossman, Walker & Woodruff, 1974) gave improved signal/noise ratio and reduced current-induced alteration of neurone firing rate. The cortex overlying one caudate nucleus was exposed and the electrode passed through the cortex into the caudate (stereotaxic co-ordinates: A 8.5, L 2.0–2.5, V + 2.0–0; atlas of Konig & Klippel, 1963).

Drugs used were: dopamine-HCl (0.5 M, pH 4.5, Sigma), morphine-HCl (0.031 M, pH 4.5, Macfarland Smith Ltd.), levorphanol tartrate (0.026 M, pH 4.5, Roche), dextrorphan tartrate (0.026 M, pH 4.5, Roche), naloxone-HCl (0.021 M, pH 4.5, Endo), α-flupenthixol (0.04 M, pH 4.0, Lundbeck), and DL-homocysteic acid (0.2 M, pH 8.0, Koch-Light).

Out of 94 neurones tested, dopamine depressed the activity of 85 and morphine depressed 45; dopamine excited 8 cells, of which morphine excited four. Naloxone antagonised the depressant effect of morphine on 14 out of 15 cells while having no effect on the response to dopamine. Levorphanol depressed the activity of all cells to which it was applied (13) and naloxone blocked this effect in 11 (out of 13). Dextrorphan produced depression of 14 out of the 20 cells on which it was tested, but this effect was not modified by naloxone. The dopamine antagonist, α-flupenthixol, was tested on 4 cells; in three cases it blocked the effects of dopamine but it had no effect on responses to morphine. In a few cases dopamine responses appeared to be reduced following application of morphine.

Since the depression of rat caudate neurones produced by iontophoretic morphine and levorphanol could be reversed or prevented by naloxone, whereas that produced by dextrorphan was not, this action of morphine may be stereo-specific. On the other hand the finding that opiate- or dopamine-antagonists selectively blocked the response to either morphine or dopamine, respectively, without modifying the response to the other compound applied to the same neurone, suggests that separate receptors may mediate these effects.

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Behavioural changes following olfactory bulbectomy in rats: a possible model for the detection of antidepressant drugs

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The battery of animal tests available to pharmacologists to detect 'antidepressant activity' of drugs is still very unspecific and yields many false positives and negatives. One such false negative was 1,2,3,4,10, 14b-hexahydro-2-methyldibenzo [c,f,]-pyrazino-[1,2-a]azepine monohydrochloride (Org GB 94) a tetracyclic with potent 5-HT and histamine antagonistic properties (Van Riezen, 1972). However, human studies have revealed that this drug has an antidepressant activity similar to and more potent than that of amitriptyline (AMI; Itil, Polvan & Hsu, 1972).

Over the last few years bilateral olfactory bulbectomy has been shown to cause many behavioural changes including increased motor activity (Ueki, Nurimoto & Ogawa, 1972), and decreased acquisition of behavioural tasks involving both reward and avoidance training (Marks, Remley, Seago & Hastings, 1971). Cairncross & King (1971) showed that behavioural deficits resulting from bulbectomy may be reversed by subchronic treatment with AMI. The following experiments were performed to investigate whether this reversal is specific for all antidepressants.

Male Sprague-Dawley rats (175–225 g) were anaesthetized with pentobarbitone sodium and subjected to either olfactory bulbectomy (OB) by means of bilateral aspiration, or to sham-operation (SO). After a two week recovery period, groups of OB and

SO rats were chronically treated (i.p.) with either saline, AMI (3 or 10 mg kg^{-1} day^{-1}), Org GB 94 (5 or 15 mg kg^{-1} day^{-1}), chlorpromazine (1 or 3 mg kg^{-1} day^{-1}), chlordiazepoxide (10 or 20 mg kg^{-1} day^{-1}), (+)-amphetamine (1 or 3 mg kg^{-1} day^{-1}) and lithium sulphate (1 or 3 mEq kg^{-1} day^{-1}). After 7 days of pretreatment motor activity was recorded in the open field test for a 2.5 min period. From day 8 onwards the rats were food deprived. Acquisition of appetite motivated behaviour was studied during 20 daily trials on days 11 and 12. A two compartment box was used. The rats were placed in one compartment and the time taken by the animals to reach a food cup on the back wall of the other compartment was recorded. Acquisition of passive avoidance behaviour was tested on day 13 by electrifying the floor of the 'food' compartment. Rats were considered as exhibiting passive avoidance when they remained in the safe compartment for 20 seconds.

Amphetamine increased, whereas chlorpromazine and chlordiazepoxide decreased open field activity in SO as well as in OB rats. The antidepressants, and to a lesser extent lithium, reduced activity in OB rats but had little effect on SO rats. AMI and ORG GB 94 also had distinct effects on acquisition. Bulbectomy produced deficient acquisition of appetite motivated and avoidance behaviour and the antidepressants reversed this deficit. However, they worsened the performance of the SO rats. A similar result was obtained with rats treated with amphetamine but not with those receiving chlorpromazine, chlordiazepoxide and lithium.

It is concluded that the OB rat is a possible model for the detection of antidepressant drugs. Using more than one behavioural test, the effects of antidepressants can easily be differentiated from those of other psychotropic compounds.

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Plasma concentrations in the monkey *(Macaca mulatta)* of six related benzodiazepines after intraperitoneal injection

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Recent studies in the monkey (*Macaca mulatta*) on the behavioural activity of benzodiazepines have been concerned with effects on delayed differentiation and spatial delayed alternation (Nicholson & Wright, 1974, 1976). We have determined the concentrations of six related benzodiazepines in monkeys from the same population. The compounds studied were: medazepam, diazepam, *N*-desmethyldiazepam (nordiazepam) and oxazepam, which are metabolized one to another in that order, plus clorazepate (a precursor of nordiazepam) and temazepam, an intermediate in metabolism of diazepam to oxazepam (Robin, Curry & Whelpton, 1974). Concentrations were determined by solvent extraction and gas-chromatography (de Silva & Puglisi, 1970). Eight monkeys were used, in groups of six for each drug, so that each monkey took part in not less than two, and up to six, trials with at least one month between trials.

Five of the six compounds have similar molecular weights (range 271–291) and their doses were 3.0 mg/kg. In contrast, clorazepate, with its molecular weight 1.4–1.5 times that of the others (409) was given at 4.5 mg/kg. Doses were in 5 ml polyethylene glycol. Samples were taken from the saphenous vein into heparin anticoagulant tubes.

Highest mean concentrations of unchanged drug were mostly at the initial time point ($\frac{1}{2}$ h). The exception was nordiazepam (1 h), (Table 1). The only compound quantitatively assessable when occurring as a metabolite was nordiazepam (after medazepam, diazepam and chlorazepate) though traces (<0.05 μg/ml) of diazepam following medazepam, of temazepam following diazepam and oxazepam, and of oxazepam following medazepam, diazepam and chlorazepate, were detected.

Table 1 Mean plasma concentrations (µg/ml) in the monkey (*Macaca mulatta*) after intraperitoneal injection

Compound		*Time (h)*					
		½	1	2	4	8	24
(i) *Unmetabolized drugs*							
Medazepam	Mean	2.41	2.27	1.60	1.06	2.04	2.05
	s.e. mean	0.40	0.35	0.27	0.18	0.48	0.37
Clorazepate	Mean	1.81	1.10	0.80	0.30	0.045	0.015
	s.e mean	0.70	0.31	0.20	0.11	0.019	0.009
Diazepam	Mean	0.55	0.33	0.11	0.043	0.033	0
	s e mean	0.13	0.07	0.02	0.011	0.013	—
Nordiazepam	Mean	2.61	2.72	2.11	1.84	1.40	0.35
	s.e. mean	0.67	0.38	0.29	0.24	0.21	0.07
Temazepam	Mean	0.71	0.46	0.17	0.042	0.023	0.002
	s e. mean	0.23	0.13	0.05	0.008	0.002	0.001
Oxazepam	Mean	1.38	0.87	0.39	0.22	0.053	0.013
	s.e. mean	0.42	0.19	0.13	0.06	0.021	0.006
(i) *Nordiazepam as a metabolite of other drugs*							
Following medazepam	Mean	0.40	1.07	1.29	1.07	1.09	0.39
	s.e. mean	0.06	0.29	0.15	0.10	0.09	0.10
Following clorazepate	Mean	0.99	1.16	1.08	0.57	0.51	0.09
	s.e. mean	0.19	0.37	0.27	0.09	0.11	0.01
Following diazepam	Mean	1.77	2.05	1.57	1.27	1.06	0.25
	s e. mean	0.39	0.38	0.20	0.21	0.13	0.05

The decline of medazepam concentrations was erratic, relatively fast at first, but with unexplained fluctuations which prevented mathematical interpretation. Diazepam, clorazepate, temazepam and oxazepam concentrations declined according to a bi-exponential model. These graphs were assessed by a method of residuals (Riggs, 1970; Curry, 1974). Mean half-times of decline for the two phases in each case were as follows: diazepam 0.50 and 9.69 h; clorazepate 0.6 and 11.0 h; temazepam 0.60 and 4.56 h; oxazepam 0.57 and 4.88 hours. Nordiazepam concentrations, which were at an overall higher level, declined following their highest levels in accordance with a single exponential model, the half-time being 8.15 hours.

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Behavioural activity in the monkey *(Macaca mulatta)* of the metabolites of diazepam in man

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In previous studies in the monkey *(Macaca mulatta)* we showed that diazepam (3.0 mg/kg) increased total response time and impaired accuracy of response on a delayed differentiation task (Nicholson & Wright, 1974). In the present studies we have examined the activity of the principal metabolites of diazepam, N-desmethyldiazepam (nordiazepam), 3-hydroxydiazepam (temazepam) and 3-hydroxy-N-desmethyldiazepam (oxazepam), using both delayed differentiation and spatial delayed alternation. Five monkeys were trained on each task. The four drugs (diazepam and its three metabolites) were given by intraperitoneal injection (1.8 and 3.0 mg/kg) in 5 ml polyethylene glycol. Delayed differentiation was tested 2 and 6 h after injection, and delayed alternation was tested 2 h after injection. The data were analysed by analysis of variance.

With differentiation there were no effects after temazepam or oxazepam, and effects with diazepam and nordiazepam were observed at 2 h only. Both doses of diazepam and nordiazepam increased total response time ($P<0.01$). Diazepam impaired accuracy of response to matching on NO-GO responses ($P<0.001$), and nordiazepam impaired accuracy of response to matching on both GO ($P<0.05$) and NO-GO ($P<0.05$) responses. With alternation there were no effects after temazepam or oxazepam. Both doses of diazepam impaired behaviour ($P<0.01$), but the effect of nordiazepam $P<0.05$) was limited to the higher dose.

In further experiments alternation was tested 4 and 6 h after 3.0 mg/kg nordiazepam. The mean plasma level (1.84 μg/ml) of nordiazepam 4 h after 3.0 mg/kg nordiazepam is similar to that (1.57 μg/ml) of nordiazepam 2 h after 3.0 mg/kg diazepam (Curry, Nicholson & Whelpton, 1976), but no impairment was observed. These findings, together with the observation that the activity of diazepam is changed by demethylation, suggest that the effect of diazepam is unlikely to be due solely to nordiazepam. With temazepam and oxazepam the absence of behavioural effects may have been related to their fast equilibration half times — 0.60 and 0.57 h respectively. However, no impairment was observed with alternation 1 h after 3.0 mg/kg temazepam or oxazepam. Mean plasma levels of temazepam and oxazepam are 0.46 and 0.87 μg/ml at 1 h compared with 0.17 and 0.39 μg/ml respectively at 2 h (Curry *et al.*, 1976).

These studies using identical doses of diazepam and its principal metabolites indicate that, though behavioural activity persists after demethylation (nordiazepam), hydroxylation (temazepam and oxazepam) is accompanied by a loss of, or a considerable reduction in, activity. Diazepam, nordiazepam and temazepam (each 10 mg orally) are hypnotics in man (Nicholson & Stone, 1976; Nicholson, Stone, Clarke & Ferres, 1976), and so behavioural activity represented by impaired differentiation and alternation is not an inevitable property of such benzodiazepines.

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Plasma levels of clomipramine and its N-desmethyl metabolite following oral administration of clomipramine in man

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Clomipramine is a tricyclic antidepressant which has been in clinical use for a number of years, however, only limited information is available on blood levels (Faigle & Dieterle, 1973). For this reason, we have determined plasma concentrations of clomipramine together with its *N*-desmethyl metabolite following oral administration of single and multiple doses of clomipramine in man. Analysis of plasma samples was carried out using a modification of the double radioisotope derivative technique described by Riess (1974) for the quantitative estimation of maprotiline in body fluids.

Five healthy male volunteers received a single oral dose of clomipramine (50 mg) after being fasted overnight. Venous blood samples were collected before and at various times up to 48 h after dosing. Clomipramine appeared rapidly in the plasma and reached peak levels between 2.0 h (37.1 ± 10.4 (s.e. mean) ng/ml) and 4.0 h (38.1 ± 7.8 ng/ml). The mean value of individual peak plasma levels was 44.8 ng/ml (range 22.5–64.6 ng/ml). On the other hand, desmethylclomipramine was not detected in the plasma until 1.0 h after dosing and reached maximum concentrations between 4 and 24 h of 0.5–12.0 ng/ml (mean 5.0 ng/ml). Both parent drug and metabolite were still detectable at 48 h indicating relatively long plasma half-lives for both substances.

In a multi-dose study carried out in nine patients diagnosed clinically as endogenous depressives, clomipramine (25 mg) was administered orally three times daily for four weeks. Venous blood samples were collected immediately prior to the first dose and at 7, 14 and 28 days. Steady-state plasma levels of clomipramine were reached at day 7 and mean individual values ranged from 21.4 to 64.2 ng/ml (mean 38.6 ng/ml). In contrast, mean plasma levels of desmethylclomipramine continued to rise during the treatment period from 48.9 ± 8.4 ng/ml at day 7 to 68.7 ± 17.1 ng/ml at day 28.

Marked individual variation in the ratio between the tertiary amine and its secondary amine metabolite was noted in the patient study indicating the varying abilities of individuals to metabolize clomipramine. In the majority of patients, plasma levels of metabolite were greater than parent drug and since desmethylclomipramine possesses biological activity (Sigg, Soffer & Gyermek, 1963; Carlsson, Corrodi, Fuxe & Hökfelt, 1969) it may be a major contributory factor in the overall antidepressant effect of administered clomipramine.

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Inducing dependence by a single administration of morphine in rats

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Studies on acute dependence in rodents have chiefly centred on antagonist-induced jumping in morphine treated mice, by which some workers claim to have assessed dependence following a single injection of opiate (Cheney & Goldstein, 1971; Smits, 1975). However, the validity of such a measure has been disputed (Barthelemy & Jacob, 1972; Kosersky, Harris & Harris, 1974). A conditioned aversion technique, which has been shown to permit reliable assessment of dependence in rats receiving low doses of morphine (Pilcher & Stolerman, 1975) has now been employed to investigate single dose effects.

Rats were adapted to drinking their daily fluid intake in two sessions totalling one hour. The first of these was for 15 min from 10.00 h and the second was for 45 min from 17.00 hours. After eight days on this schedule, water intakes had stabilized. On day 9 a solution of sodium saccharin (0.1% w/v in distilled water) was presented to all rats in the 15 min session only (medium intake 9.5 ml). Each animal had received a single injection of either morphine hydrochloride or physiological saline at intervals ranging from 1.5 to 24 h before the flavour presentation. All injections were intraperitoneal. Immediately after the 15 min session the rats were injected with either naloxone hydrochloride or saline. Water was provided in the afternoon session and on the following day. On the second day after the first flavour presentation, sodium saccharin was again presented in the 15 min session and water in the afternoon session.

When morphine at 10 mg/kg was given 1.5 h before an injection of naloxone at a dose of either 1.0 or 10 mg/kg, a marked and significant reduction in subsequent saccharin intake was observed (5.9 ml and 6.3 ml respectively; $n=6$, $P<0.03$). With a single dose of morphine at 10 mg/kg, naloxone at 10 mg/kg also suppressed intake (4.5 ml; $n=6$, $P<0.05$) at agonist-antagonist intervals up to 12 hours. When morphine was increased to 30 mg/kg, significant aversions were obtained with naloxone at 0.32; 1.0, 3.2 ($n=6$, $P<0.05$) and 10 mg/kg ($n=12$, $P<0.02$) 24 h later. There was no difference in the degree of aversion at the three lowest doses but the greatest reduction in intake was seen with the highest dose.

Control rats receiving saline before the flavour presentation and naloxone (0.32; 1.0, 3.2 or 10 mg/kg) immediately after it, showed no significant difference in intake in the second flavour trial, when compared with rats receiving saline in both injections. In control rats receiving saline 1.5 h after morphine, a slight but non-significant reduction in intake was seen. However, at intervals of 3 h or longer intake was not suppressed in the morphine-saline groups, even with doses of morphine up to 30 mg/kg.

It appears therefore, that those processes induced by morphine and which are implicated in the aversiveness of withdrawal, are initiated within 1.5 h of first exposure to the opiate in the rat. Moreover, the conditioned aversion technique extends the finding to the rat, that a single low dose of morphine is capable of producing manifestations of dependence.

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Some behavioural and EEG studies on the behavioural depression induced in the rat by ethanolamine O-sulphate, an inhibitor of GABA-transaminase

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Ethanolamine O-sulphate (EOS), an irreversible active-site-directed inhibitor of GABA transaminase (Fowler & John, 1972) when injected intracerebroventricularly in mice elevated whole brain GABA concentrations and induced a behavioural depression characterized by decreased locomotor activity, ptosis and hypothermia (Baxter, Fowler, Miller & Walker, 1973). We have now compared the effects in rats (male, 250 to 350 g) of chlorpromazine (CPZ) injected subcutaneously and EOS, injected intraventricularly (i.v.c.) in three tests known to reveal CPZ-like activity: apomorphine antagonism, shock avoidance conditioning and effects on the electroencephalogram (EEG).

The doses of EOS used in these studies (160 to 320 µg) significantly elevated brain GABA concentrations. Ethanolamine O-sulphate was administered i.v.c. to rats briefly anaesthetized with halothane and the brain GABA concentrations were assayed fluorometrically after 24 h by the methods of Lowe, Robins and Eyerman (1958) and Uchida & O'Brien (1964). GABA concentrations were significantly elevated at all doses ($P \leqslant 0.005$, $n=4$). In a further test, EOS at 240 μg was found to significantly increase brain GABA concentrations from 2 to 72 h after drug ($P<0.05$, $n=3$ to 6).

In the apomorphine test EOS at 240 and 320 μg injected i.v.c. under brief halothane anaesthesia 24 h previously failed to antagonize gnawing induced by apomorphine (5 mg kg^{-1} s.c.) given 30 min prior to observation. In contrast, CPZ given 1 h previously, completely antagonized apomorphine-induced gnawing ($ED_{50}=2.3$ mg/kg s.c.).

In the shock avoidance conditioning test (shuttle boxes) trained rats received 1 h blocks of conditioning trials (trial interval 1 min) after administration of EOS at 160, 200 or 240 μg ($n=6$ per treatment) through an indwelling intraventricular cannula. Mean hourly response latencies (RL) were significantly increased ($P\leqslant0.05$) at 5, 24 and 48 h by 200 and 240 μg. EOS at 160 μg was ineffective. CPZ (2.5 mg/kg s.c.) tested at 1, 3 and 5 h post-drug significantly increased ($P=0.01$) RL values at all times. No obvious relationship between elevated brain GABA concentrations and behavioural depression was revealed in this test.

EEG studies were undertaken in rats chronically implanted with skull electrodes and an indwelling intraventricular cannula (Goff, Miller, Smith, Smith & Wheatley, 1975). The parietal EEG, recorded on magnetic tape, was analysed (10 s periods at 10 s intervals) by passing it through four broad wave band filters which measured the voltage within each of the following frequencies: 2.4 to 4.0, 4.0 to 7.5, 7.5 to 13.5 and 13.5 to 26.0 Hz (Nos. 1 to 4 respectively). The mean voltage, in hourly blocks was calculated for pre- (2 h) and post-drug periods (CPZ at 0–4 h; EOS at 0–4, 24, 48 h and 7 days). CPZ ($n=4$) at 8.4 mg/kg s.c., (the ED_{95} in the apomorphine test), significantly increased ($P\leqslant0.05$) voltages in Filters 1 and 2 and total voltage at all times, but voltages in Filters 3 and 4 were only significantly increased at 1 to 4 h and 2 to 4 h respectively. EOS at 240 μg ($n=3$) significantly increased ($P<0.05$) total voltage and voltages in Filters 1 to 3 (at 24 and 48 hours).

The studies have revealed that the behavioural depression associated with increased brain GABA concentrations induced by EOS in rats differs from CPZ-induced depression in some important respects.

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The effects of three tricyclic antidepressants on arterial ^{3}HNA uptake and arterial responsiveness to noradrenaline (NA)

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The tricyclic antidepressant clomipramine has been used in the therapy of obsessional neurosis in which it is demonstrably more effective than either imipramine or amitriptyline (Rack, 1973). Both imipramine and amitryptiline are potent inhibitors of noradrenaline (NA) uptake (Iversen, 1967) and in this study the effects of imipramine, amitriptyline and clomipramine on arterial NA uptake and arterial responsiveness to NA were investigated.

Rat mesenteric arteries were prepared and perfused as previously described (George & Leach, 1973). To measure the uptake of [^{3}H]-NA, the preparation was perfused for 30 min with normal Krebs solution containing (–)-[^{3}H]-NA 0.42 μCi/ml and carrier (–)-NA to give a final NA concentration of 200 ng/ml. Ascorbic acid (20 mg/l) and disodium E.D.T.A. 10 mg/l were added to stabilize (–)-NA. The [^{3}H]-NA content of the arteries was determined as described by Iversen (1963) and radioactivity counted as described by George & Leach (1975). Dose response curves were obtained to NA alone and, to NA in the presence of each of the tricyclic compounds separately. The perfusion concentrations used were 1×10^{-6} M and 1×10^{-8} M. [^{3}H]-NA uptake was measured in the absence of any drug and the effect of each drug on [^{3}H]-NA uptake was determined separately using a range of perfusion concentrations (5×10^{-6} M–1×10^{-8} M). Each of the drugs, when present in the perfusion solution caused a potentiation of the responses to NA above the control values. The control ED$_{50}$ response to NA was potentiated by 60% in the presence of imipramine and by 50% and 40% respectively in the presence of amitriptyline and clomipramine (1×10^{-6} M). At a perfusion concentration of 1×10^{-8} M, however, the ED$_{50}$ NA response was potentiated by 30% in the presence of clomipramine, by 20% in the presence of imipramine and by 10% when amitriptyline was present. Each of the three drugs inhibited NA uptake when compared to control values in the absence of any drug. At a concentration of 1×10^{-8} M clomipramine inhibited NA uptake by 30% while amitriptyline and imipramine inhibited NA uptake by 15% and 20% respectively, compared to control values. During perfusion with imipramine (1×10^{-6} M) NA uptake was inhibited by 80% while in the presence of clomipramine and amitriptyline respectively, NA uptake was depressed by 55% and 65% respectively.

These results suggest that all three tricyclic depressants are potent inhibitors of NA uptake. Clomipramine is the most potent inhibitor of NA uptake at a perfusion concentration of 1×10^{-8} M, while imipramine is the most potent inhibitor of NA uptake at a concentration of 1×10^{-6} M. There was a direct correlation between the effects of each drug on NA uptake and the effects on arterial responsiveness to NA. The differences in potencies between clomipramine and the other tricyclic compounds at different perfusion concentrations might explain the greater effectiveness of clomipramine in some disorders.

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Stereoselective uptake of L-homocysteate by rat brain slices

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On microelectrophoretic administration around mammalian central neurones, D-homocysteate appears to be a more potent and longer-acting excitant than L-homocysteate (Curtis & Watkins, 1963). In potency and in time course of action, the latter amino acid resembles L-glutamate, which is well known to be actively taken up by central nervous tissue. Since the time course of concentration changes around receptor sites may be influenced by such uptake systems, and thus affect the excitation characteristics of an amino acid, a study has been conducted on the relative rates of uptake of D- and L-homocysteate by rat brain slices.

$[^{35}S]$-L-Homocysteic acid was prepared by oxidation of $[^{35}S]$-L-homocysteine thiolactone with bromine. Unlabelled D- and L-homocysteic acids were prepared in a similar way from the appropriate isomers of homocystine (Watkins, 1962). Rat cerebral cortex slices were preincubated for 40 min at 37°C in Krebs bicarbonate medium (mM: NaCl, 124; KCl, 5; KH$_2$PO$_4$ 1.2; MgSO$_4$ 1.3; CaCl$_2$ 2.8; NaHCO$_3$, 26; D-glucose 10, adjusted to pH 7.4). The slices were transferred to fresh medium containing various concentrations of amino acids and further incubated at 37°C for periods of 0 to 20 minutes. The tissue content of $[^{35}S]$-L-homocysteate was estimated directly by scintillation counting of the hyamine-digested slices, and unlabelled D-, L- or DL-homocysteate were determined by ninhydrin reaction after ion exchange separation from endogenous amino acids. Metabolism of $[^{35}S]$-L-homocysteate was assessed by high voltage paper electrophoresis and by paper chromatography of an aqueous ethanol extract of the tissue.

On incubation of brain slices with unlabelled D- or L-homocysteate (2.5 mM) for 10 min, only the L form was actively accumulated. Two transport systems for $[^{35}S]$-L-homocysteate were recognized, these exhibiting low and high affinity characteristics (apparent Km 7 ± 2 mM and 10 ± 3 µM; Vmax 4 ± 1 µmol. g wet wt.$^{-1}$ min^{-1} and 8 ± 3 nmol. g wet wt.$^{-1}$ min^{-1}, respectively). Low affinity uptake of $[^{35}S]$-L-homocysteate (0.1 mM) was inhibited 20–50% by 1 mM L-glutamate, D-glutamate, L-aspartate and D-aspartate, and 61% by 1 mM *p*-chloromercuriphenylsulphonate. D-Homocysteate (1 and 10 mM) did not significantly inhibit low affinity uptake. High affinity uptake of [^{35}S]-L-homocysteate (0.1 μM) was not significantly inhibited by 0.1 mM D- or L-glutamate, D- or L-aspartate or D-homocysteate, but was inhibited 70% by 0.1 mM *p*-chloromercuriphenylsulphonate. At 0°C, low affinity uptake as reduced by more than 90% and high affinity uptake was abolished. No metabolism of [^{35}S]-L-homocysteate (0.1 mM) was detected (37°C/10 min).

These results provide a possible explanation for the different characteristics of neuronal excitation produced by D- and L-homocysteate. The functional significance of the energy-dependent uptake systems for L-homocysteate, the high affinity component of which appears to possess 'a high degree of stereospecificity, remains to be investigated.

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The response of the rat anococcygeus muscle to stimulation of the individual extrinsic nerves and its modification by drugs

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Two extrinsic nerves supply the rat anococcygeus (Gillespie & Lullman-Rauch, 1974). These nerves subdivide and supply a nerve plexus comprising ganglia and interconnecting tracts. In this study the response of the muscle to stimulation of each of the two extrinsic nerves has been compared with that to stimulation of the combined extrinsic nerve supply and that to field stimulation (Gillespie, 1972).

Each nerve (one a branch of the external spermatic division of the genito-femoral nerve and the other a branch of the posterior scrotal division of the perineal nerve) was stimulated individually (1–100 Hz for 5 s, 0.3 ms, supramaximal) with suction electrodes positioned 0.5–1 cm from the muscle which was perfused with a modified saline solution (Creed, Gillespie & Muir, 1975).

A contraction (latency 0.5–2.5 s) was produced on stimulation of either nerve (optimal frequency about 50 Hz); the contraction following stimulation of the external spermatic branch was usually the larger. No contraction was produced on stimulation of either nerve with a single stimulus or indeed below 2 Hz. The excitatory response was abolished by tetrodotoxin (TTx, 1 μg/ml) or by phentolamine mesylate (Ph) (10 μg/ml) confirming earlier suggestions (Gillespie, 1972) that it was mediated via an adrenergic nerve pathway. The excitatory response was reduced by the ganglion blocking agents, tubocurarine chloride (Tc, 0.1 mg/ml) or hexamethonium bromide (C_6, 0.5 mg/ml).

When the tone of the muscle was raised (e.g. following carbachol chloride (2 μg/ml) with or without subsequent Ph (10 μg/ml), or following guanethidine sulphate (9 μg/ml) or in a few instances in the absence of any drug) stimulation produced an inhibitory response in about half the experiments. The most obvious explanation for the absence of inhibitory responses in some muscles is that the fibres were missed or damaged in the dissection. When present, the inhibitory responses resulted from stimulation of either or both extrinsic nerves. The inhibitory response which had a variable latency (1.5–5 s) was abolished by TTx (1 μg/ml). The inhibitory response (optimal at about 10 Hz) was not reduced and indeed in some cases was increased in amplitude and/or prolonged by either C_6, or Tc (up to 1 mg/ml) or atropine sulphate (up to 1 μg/ml).

The present evidence, in contrast to previous views (Gillespie, 1972) suggests that synaptic interruption occurs in the excitatory pathway—probably in the ganglionic plexus lying close to the muscle. Two puzzling features of the inhibitory response require explanation—its long latency and the effects of acetylcholine antagonists. The organization of the inhibitory pathway remains obscure.

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Responses of dorsal horn units in cat spinal cord to some putative transmitters and to cutaneous stimulation

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Although attempts have been made to study the pharmacology of sensory transmission in the spinal cord (Game & Lodge, 1975; Henry, Krnjević & Morris, 1975; Randić & Yu, 1975) our knowledge remains limited.

In decerebrated or chloralose-anaesthetized cats, single units in the dorsal horn of the lumbar cord were studied to determine whether a correlation exists between responses to microiontophoretic application of some putative transmitters and those to peripheral stimulation. Stimuli used were: noxious thermal (radiant heat from a 250 W infrared bulb) and non-noxious (air stream, camel hair brush, gentle manual pressure).

One hundred and fifteen units were tested. Most units, regardless of the response to natural stimulation, were excited by glutamate and depressed by GABA. Substance P and bradykinin caused slow prolonged excitation of nociceptive units but failed to affect non-nociceptive units. Noradrenaline most commonly caused depression, although no correlation was found with a specific peripheral stimulus. 5-Hydroxytryptamine caused excitation and depression of approximately equal numbers of units; neither effect was clearly associated with a specific stimulus. In general, units located more dorsally tended to be depressed by 5-hydroxytryptamine, while those located more ventrally tended to be excited. Acetylcholine was usually without effect.

Although the pharmacology of pathways involved with specific sensory modalities is still far from clear these results suggest that Substance P and bradykinin may be associated with chemical transmission in spinal pathways subserving nociception and that glutamate and GABA might also be involved in transmission, although their effects are not associated with a specific sensory modality.

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GABA antagonism as a possible basis for the convulsant action of a series of bicyclic phosphorus esters

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Compounds with the general formula 4(R)-1-Phospha 2,6,7-trioxabicyclo (2,2,2) octane-1-oxide ((R)PTBO where R = alkyl group, Figure 1) are potent convulsants (Bellet & Casida, 1973).

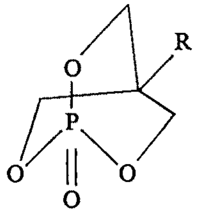

Figure 1

Intravenous or topical application of the isopropyl (IPTBO), ethyl (EPTBO) or pentyl (PPTBO) derivatives antagonizes the depressant action of microiontophoretically applied GABA in the rat medulla (Bowery, Collins & Hill, 1976). A quantitative comparison of the PTBO series as GABA antagonists was accordingly made *in vitro* on the isolated superior cervical ganglion of the rat (Bowery & Brown, 1974) and on the isolated hemisected spinal cord of the frog (Tebecis & Phillis, 1969).

Ganglia were excised from rats under urethane anaesthesia (1.5 g/kg) and suspended between two non-polarizable Ag$^+$/AgCl electrodes placed in contact with the post-ganglionic trunk and the ganglion body. The tissue was superfused at 1 ml/min with Krebs solution (containing hyoscine 2.6 µm) at 25°C and the potential difference across the electrodes monitored on a Servoscribe 1 s chart recorder. Addition of GABA or carbachol to the superfusate produced a dose dependent depolarization of the ganglion (Bowery & Brown, 1974). Concurrent application of PTBO derivatives antagonized the depolarizing action of GABA but not that of carbachol.

Spinal cords were dissected from decerebrated frogs and hemisected. Half-cords were transferred to a cooled perfusion apparatus (10°C) and dorsal roots mounted on Ag$^+$/AgCl electrodes for DC recordings. The trans-synaptic actions of drugs were eliminated by the addition of procaine to the superfusing solutions as described by Evans & Watkins (1975) and Tris buffer was used to maintain pH neutrality. Application of GABA, glycine or glutamate (0.5 to 4 mM) produced dose-dependent depolarization of dorsal roots. Concurrent exposure to the PTBO compounds produced antagonism of the GABA-induced depolarization but did not reduce the glutamate or glycine responses.

In both ganglion and dorsal root the potency ranking of the compounds as GABA antagonists was IPTBO > EPTBO > PPTBO which is in the same order as the convulsant potency. The potency of IPTBO as a GABA antagonist was comparable with that of bicuculline methochloride and picrotoxin. It was, therefore, concluded that the PTBO compounds are effective and specific GABA antagonists when tested on either preparation. The potency ranking suggests that the convulsant properties of the PTBO series may be due to antagonism of the actions of synaptically-released GABA.

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Evidence for a specific somatosensory receptor in the cat skin that responds to irritant chemicals

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The irritant chemical dibenzoxazepine (CR) produces a sensation of burning pain when applied to the human skin (Ballentyne, Beswick & Price-Thomas, 1973) and acts on somatosensory receptors in the cat related to unmyelinated nerve fibres (Foster & Ramage, 1975). Further investigations have sought to classify the type of sensory receptor acted upon by CR and by ω-chloroacetophenone (CN), *o*-chlorobenzylidene malononitrile (CS), *n*-nonyl vanillylamide (VAN) and capsaicin (CAP).

Cats were anaesthetized with α-chloralose (70–90 mg/kg). Multifibre or single unit activity was recorded (Iggo, 1960) from the saphenous nerve.

Irritants (5×10^{-4} M in saline to 10^{-1} M in alcohol) were tested by topical application to the receptor area. Analysis of results employed a computer method (Foster & Ramage, 1976).

In 18 low threshold alpha mechanoreceptor units activity was only induced indirectly when local oedema was caused by the irritant.

Twenty moderate to high threshold alpha delta mechanoreceptor units which are believed to be responsible for a sensation of sharp pain (Landau & Bishop, 1958), were not activated by the irritants; nor were 10 low threshold C-mechanoreceptor units.

Very high threshold C-mechanoreceptor units, which adapt rapidly, and a cold thermoreceptor unit were not activated by the irritants. A warm thermoreceptor unit did show an increase in activity to CR 10^{-4} M (Foster & Ramage, 1975) but this was an indirect effect associated with erythema.

Increase in activity was consistently induced by these irritants in 17 moderate–high threshold C-mechanoreceptor units (with conduction velocities 0.3–1.0 m/s). The order of relative potency of the irritants was VAN > CAP > CR > CN > CS. CN, CR and VAN generally induced rapid tachyphylaxis and cross tachyphylaxis. When a receptor had developed tachyphylaxis to VAN, exposure to CN and CR failed to elicit activity. However when a receptor had developed tachyphylaxis to CN and CR, exposure to VAN still elicited activity. CAP seemed in this respect to be similar to VAN.

The onset of response to CR, CN and CS (5×10^{-4} M) showed a delay of 5.0–8.1 min whereas VAN was immediately (< 1.4 min) effective. When CR was applied in an alcoholic solution of 10^{-1} M, or the skin over the receptor area was broken, onset of activity was immediate. This suggests that the delay was mainly due to the permeability barrier of the skin. The average duration of action of most of these irritants was 24.3 min, though the action of CAP was briefer (approx 10 min).

The observation that these irritants affect selectively high-moderate C-mechanoreceptor units is consistent with the concept that C-fibre stimulation is associated with a sensation of dull burning pain (Landau & Bishop, 1958). Thus these chemical irritants could represent a useful tool for identifying peripheral nociceptors.

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Profiles of different anti-allergy effects of a new histamine antagonist, BM 15,100

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Several anti-allergy compounds possess multiple actions on the anaphylactic mechanism, including inhibition by H_1 histamine-receptor blocking agents of antigen-induced histamine release. This effect, was shown by Lichtenstein & Gillespie, 1975, in the isolated, sensitized human leucocyte preparation, *in vitro*, by concentrations of the order of 10^{-4} M. The high concentrations required for inhibition lead these authors to doubt the practical significance of their finding. We investigated a new histamine antagonist, BM 15,100:3,4-dimethyl-7-[4-(*p*-chlorobenzyl)-piperazin-1-yl]-propoxycoumarin.dihydrochloride, (Boehringer Mannheim), assessing its antagonism to histamine and other agonists. Its ability to inhibit anaphylactic histamine release in the human leucocyte test model was also investigated. Histamine release was measured by a spectrofluorometric technique.

We found BM 15,100 to be a potent antagonist of histamine in guinea-pig ileum, with a pA_2 of 9.8, after 3 min pre-incubation with antagonist, and in guinea-pig spiral tracheal strips.

Concentrations exceeding 10^{-6} M lead to irreversible antagonism and lack of recovery, which could not be averted by increasing the agonist concentration. BM 15,100 also showed relatively weak antagonism of slow reacting substance of anaphylaxis, 5-hydroxytryptamine, prostaglandins E_1, E_2 and $F_{2\alpha}$, bradykinin, and angiotensin in isolated guinea-pig ileum, with pA_2 values ranging from 5.6 to 6.1 for all of these agonists. The compound also antagonized PGE(s), $PGF_{2\alpha}$, and angiotensin in rat uterus, with pA_2 values of similar order. This compound also inhibited antigen-induced histamine release from sensitized human leucocytes, but the dose-response curve exhibited a point of inflexion. Thus, small inhibition was seen with 10^{-7} M which increased to a maximum of 75 to 100% with concentrations ranging from 10^{-6} to 10^{-5} M, but further increase to 10^{-4} M not only reduced the inhibition, but occasionally produced histamine release by itself.

Another effect that this compound possessed was its ability to inhibit the uptake of labelled histamine by isolated human leucocytes, in a dose-dependent fashion. This is a property of histamine antagonists, recently reported by one of us (Assem, 1976).

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Anti-allergic properties of a new coumarin compound (BM 15,100)

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BM 15,100, a compound chemically defined as 1-(4-Chlorobenzyl)-4 3-(3,4-dimethylcoumarin-7-yl-oxy)-propyl -piperazine dihydrochloride combines two types of pharmacological activity useful for medical therapy of anaphylactic diseases such as atopic asthma and hay fever: (1) inhibition of mediator release from tissue mast cells and (2) antagonism to the effect of mediators.

The passive cutaneous anaphylactic (PCA) reaction in rats mediated by reaginic antibodies (Goose & Blair, 1969) was significantly inhibited by BM 15,100 (0.75 mg/kg i.v.). The same dose of this compound significantly suppressed degranulation of mesenteric mast cells (MD) (Fügner, 1973) and the cutaneous reaction elicited by intradermal injection of histamine. The PCA- and MD-inhibitory activity of BM 15,100 was similar to that of disodium cromoglycate (DSCG). Mepyramine antagonized PCA at a dose of 3 mg/kg i.v. whereas 0.38 mg/kg i.v. were sufficient to inhibit the histamine reaction. These results suggest that the PCA inhibition by BM 15,100 observed in our experiments was caused mainly by suppression of MD and only partly by the antihistamine activity. In contrast to the lack of activity of DSCG on oral administration, oral doses of BM 15,100 inhibit PCA in the rat significantly at doses nearly identical with the corresponding intravenous doses.

The oral antianaphylactic activity was also demonstrated in experiments with guinea pigs. Conjunctival oedema and hyperaemia in anaphylactic conjunctivitis (Dwyer, Turk & Darougar, 1974) were inhibited significantly by BM 15,100 at a dose of 0.75 mg/kg, anaphylactic bronchospasm (Davies & Johnston, 1971) was suppressed significantly with 0.4 mg/kg orally.

The naturally occurring allergy of monkeys to ascaris-antigen can be considered as a reliable *in vivo* model of human reagin mediated anaphylaxis. Active cutaneous anaphylactic (ACA) reactions were evoked in stump tail monkeys by intradermal injections of different dilutions of ascaris antigen (Perper, Sanda & Lichtenstein, 1972), and one cutaneous reaction in every experiment by intradermal injection of histamine. We measured the skin reaction by multiplying the diameter of the wheal by an arbitrary score for colour intensity. BM 15,100 in a dose as low as 0.1 mg/kg, given orally, significantly and strongly inhibited ACA whereas the histamine reaction was suppressed to a lesser degree. With doses up to 0.8 mg/kg there was no further increase in ACA inhibition but a clear dose-response relationship for the histamine antagonism could be seen. This finding is in agreement with the above-mentioned result from the intravenous injection into rats in so far as the histamine antagonism does not seem to be decisive for the inhibition of the anaphylactic reaction by BM 15,100.

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Atypical adrenergic modulation of allergic histamine release from bovine leucocytes

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Histamine is released from sensitized mast cells and leucocytes of several species, following exposure to specific antigen. Modulation of this release by adrenoceptor stimulants has been studied principally in two systems: isolated human leucocytes (Bourne, Lichtenstein, Melmon, Henney, Weinstein & Shearer, 1974), and chopped lung of man, guinea pig and monkey (see Assem, 1974). In both systems, β-adrenoceptor stimulation elevates intracellular cyclic AMP concentrations and inhibits histamine release. Stimulation of α-adrenoceptors enhances histamine release from chopped lung, but is without effect on isolated human leucocytes. A study of the adrenergic modulation of allergic histamine release from bovine leucocytes revealed radical differences from the systems described above.

As previously described (Holroyde & Eyre, 1975), granulocytes were isolated (94% purity) from venous blood of 6 week old Jersey and Guernsey calves which had been sensitized to horse plasma. Aliquots of the granulocyte fraction (approximately 18×10^6 leukocytes) were incubated at 37°C for 30 min in Tris buffer (Holroyde & Eyre, 1975) together with sufficient horse plasma to release 40–60% of the total available histamine. Adrenoceptor agonists (10^{-6}–10^{-3}M) were added to the incubate 2 min before the horse plasma; adrenoceptor antagonists were added 2 min before the agonists. Histamine release was determined fluorometrically.

Isoprenaline ($n=6$) potentiated histamine release at 10^{-6} M and 10^{-5} M ($P<0.05$), but inhibited at higher concentrations ($P<0.01$). In the presence of 10^{-5} M propranolol, the potentiation was reversed to significant inhibition. In the presence of 10^{-5} M phentolamine, the potentiatory phase was significantly enhanced and the inhibitory phase somewhat reduced. Phenylephrine (10^{-6}–10^{-3} M) produced only inhibition of histamine release. These results indicate the presence of both α- and β-adrenoceptors on bovine granulocytes. Stimulation of α-adrenoceptors causes inhibition of histamine release, whereas β-stimulation causes potentiation. This is the exact opposite of the situation in all other species so far described.

Adrenaline, which inhibits the release of most mediators of allergy in all species examined, significantly potentiated the release of histamine in this study (10^{-8}–10^{-3} M, $n=5$).

It is clear that the bovine granulocyte is regulated by adrenoceptors in a manner radically different from any other comparable immunological system so far described.

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An investigation of histamine aerosol induced reflex bronchoconstriction in the anaesthetized dog

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The role of the vagus nerve in histamine-induced bronchoconstriction in anaesthetized dogs appears variable. Some workers claim that histamine induced bronchoconstriction is entirely reflex (Gold, Kessler & Yu, 1972; Nadel, 1974), while others have attributed a significant proportion of the bronchoconstriction to the direct action of histamine on bronchial smooth muscle (Krell, Chakrin & Wardell, in press). The purpose of this communication is to try to offer some explanation for these differing views.

Using anaesthetized beagle dogs we have measured changes in airways resistance (R_L) and dynamic lung compliance (Cdyn) after administration of histamine aerosol. The dogs were respired at constant pressure with a Bird Mk. VII ventilator. The reflex component of histamine induced bronchoconstriction was determined by bilateral vagal cooling.

A comparison was made between the effects on R_L and Cdyn of 4 breaths of 2 aerosols of different particle sizes in 11 dogs anaesthetized with pentobarbitone sodium (30 mg/kg i.v.-followed by 0.1 mg kg^{-1} min^{-1}). Using a Bird micro-nebulizer, which produced particles of 0.5 µm mean diameter, relatively small increases in R_L were produced (e.g. 4 inhalations of an aerosol generated from a 0.5% w/v solution histamine produced increases in R_L of

0.7 ± 0.02 cmH_2O $l^{-1} s^{-1}$ $n=6$). A 'Vaponefrin inhalajet' nebulizer modified to produce an aerosol containing particles of 10 µm mean diameter produced much greater changes in R_L (e.g. 4 inhalations of an aerosol generated from a 0.5% w/v solution histamine produced increases in R_L of 6.5 ± 1.4 cmH_2O $l^{-1} s^{-1}$ $n=6$). However, the bronchoconstriction resulting from using histamine aerosols generated from either nebulizer was not inhibited by bilateral vagal cooling.

A further series of experiments was performed to compare the effects of histamine aerosol of 10 µm mean particle size on R_L and Cdyn in dogs anaesthetized with pentobarbitone sodium with those anaesthetized with chloralose (80 mg/kg i.v. followed by 10–15 mg every 15 minutes). Histamine aerosols of 10 µm now produced marked increases in R_L even when comparatively low concentrations of histamine solution were used to generate the aerosol (e.g. 4 inhalations of a 10 µm aerosol generated from a 0.125% w/v solution of histamine produced increases in R_L of 12.7 ± 1.9 cmH_2O $l^{-1} s^{-1}$ $n=6$, in dogs anaesthetized with chloralose compared with 1.6 ± 0.8 cmH_2O $l^{-1} s^{-1}$ in dogs anaesthetized with pentobarbitone sodium). In dogs anaesthetized with chloralose the increase in R_L was significantly inhibited by vagal cooling, while the falls in Cdyn were largely unaffected.

The effects of direct electrical stimulation of the efferent vagal nerves were also noted in these experiments. Stimulation of the vagus nerves in dogs anaesthetized with pentobarbitone sodium produced a mean increase in R_L of 1.2 ± 0.4 cmH_2O $l^{-1} s^{-1}$, while vagal stimulation in dogs anaesthetized with chloralose produced a much greater increase in R_L of 12.4 ± 1.8 cmH_2O $l^{-1} s^{-1}$. (Stimulation parameters: 20 Hz 1 ms at supramaximal voltage.) It was further noted that i.v. administration of pentobarbitone sodium to the chloralose anaesthetized dog significantly reduced the response to direct-efferent vagus nerve stimulation (5 mg/kg by 49.4% and 10 mg/kg by 69.5%).

These experiments indicate the importance of selecting the right experimental conditions to obtain a reflex bronchoconstriction to histamine aerosol in the anaesthetized dog. Our results show that using chloralose anaesthesia and an aerosol of mean particle size 10 µm a large reflex bronchoconstriction is produced. If, however, pentobarbitone sodium is used as the anaesthetic and an aerosol of mean particle size of 0.5 µm is used, the response is almost entirely direct.

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Studies on the mechanism of action by which 5H-[1]-benzopyrano-[2,3-b]-pyridin-5-ol (AH 6696) inhibits gastric acid secretion

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Peptic ulceration in man can be treated by inhibiting the secretion of acid into the stomach. Interest in 5H-[1]-benzopyrano-[2,3-b]-pyridin-5-ol (AH 6696) arose because it is a potent inhibitor of gastric acid secretion in the rat and dog. The mechanism by which AH 6696 inhibits gastric acid secretion has been investigated.

In the urethane anaesthetized rat (Ghosh & Schild, 1958) AH 6696 (1, 3 or 10 mg/kg i.v.) caused a dose-dependent reduction of submaximal gastric acid secretion. Five female rats (80–110 g) were used per dose level and the ED_{50} values for AH 6696 to inhibit gastric acid secretion induced by histamine, pentagastrin or bethanechol were 1.6, 2.8 and 2.4 mg/kg respectively.

On the guinea-pig ileum preparation (Krebs-Henseleit solution at 32°C gassed with 95% O_2:5% CO_2) the EC_{50} values (µg/ml) for AH 6696 to inhibit contractions induced by barium chloride, acetylcholine, histamine and 5-hydroxytryptamine were [mean ± s.e. mean, $n=10$] 354 ± 48, 338 ± 40, 86 ± 25 and 28 ± 6 respectively. On the isolated right atrium preparation of the guinea-pig (Krebs-Henseleit solution at 37°C gassed with 95% O_2:5% CO_2) AH 6696 (10–100 µg/ml) failed to antagonize histamine-induced tachycardia (H_2-effect). Cardiovascular actions were investigated in 4 female cats (2.4–2.9 kg) anaesthetized with chloralose (90 mg/kg i.v.) AH 6696 (10–30 mg/kg i.v.) produced transient depressor responses of 40–80 mmHg (1 mmHg $\approx$ 133 Pa) but did not affect the vasodepressor responses to either acetylcholine or histamine. Clearly, AH 6696 has no anticholinergic, H$_2$-blocking and little or no H$_1$-blocking activity.

In conscious dogs with Heidenhain pouches AH 6696 (15–25 mg/kg orally) caused a dose-dependent inhibition (39–100%) of submaximal gastric acid secretion induced by pentagastrin, bethanechol or histamine. This effect was accompanied by an increase in the ratio of gastric mucosal blood flow to gastric acid secretion (Curwain & Holton, 1973) indicating that inhibition of secretion was not due to a primary decrease in blood flow.

Inhibition of metabolic processes in the parietal cell could reduce gastic secretion. AH 6696 (2.5 mM) had no significant effect on the rate of oxygen uptake by rabbit parietal cells (McDougal & De Cosse, 1970). Furthermore, AH 6696 (10 mM) neither inhibited nor uncoupled oxidation from phosphorylation using rat liver mitochondria with succinate or β-hydroxybutyrate as substrate. Rat stomach carbonic anhydrase (Roughton & Booth, 1946; Waygood, 1955) was not inhibited by AH 6696, 2.5 mM, whereas acetazolamide (2.5 mM) completely inhibited the enzyme. However, AH 6696 (6.5 mM) did inhibit HCO$_3^-$-stimulated ATPase from rabbit gastric mucosa (Kaskebar & Durbin, 1965; Blum, Shah, St. Pierre, Helander, Sung, Wiebelhaus & Sachs, 1971). This action could account for the observed anti-secretory activity of AH 6696.

In a sub-acute toxicity test in beagles AH 6696 (15 mg/kg orally twice daily for 8 weeks) caused lesions in the pancreas and fibrotic changes in the liver (D. Poynter, personal communication). Thus, AH 6696 has an interesting mechanism of action for inhibiting gastric acid secretion but is too toxic for use in man.

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A comparison between sulphinpyrazone and other drugs on the thrombocytopenia occurring in the Arthus reaction in the guinea-pig

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As has been shown previously in the rabbit (Butler & White, 1975) the complement-dependent thrombocytopenia of the Arthus reaction (Margaretten, Howes & McKay, 1974) may be useful for the investigation of drugs *in vivo* which are capable of having an effect on the reactivity of platelets. A range of such drugs has now been compared in guinea-pigs.

The animals were immunized with 2 mg alum-precipitated ovalbumin given subcutaneously into each of four sites on the back. Two weeks later a boosting dose of antigen (1 mg) was injected and one week after this the animals were challenged intradermally in the shaved abdomen with different doses of antigen dissolved in 0.1 ml of physiological saline.

During the first 15 min after the injection of 100 µg, 500 µg or 1 mg of ovalbumin to groups of five animals there was a mean dose-related fall in the platelet count to 74% (not significant), 53% ($P < 0.05$) and 33% ($P < 0.02$) of control, respectively. There was no statistically significant change in the platelet count during the next 15 min in either of the two groups receiving the higher dose of antigen. Blood samples were taken by cardiac puncture and anti-coagulated with sodium citrate (3.8%). Platelet-rich plasma (PRP) was separated by centrifugation of the blood at 200 *g* for 15 min at 4°C. Platelet counts in PRP were determined with the Coulter counter model D using a correction for the haematocrit.

The i.v. administration of aspirin (10 mg/kg), phenylbutazone (10 mg/kg), sulphinpyrazone (50 mg/kg) and indomethacin (1 mg/kg) 1 h before challenge with the antigen (1 mg) resulted in 47% ($P<0.05$), 56% ($P<0.05$), 79% ($P<0.05$) and 86% ($P<0.02$) inhibition of the thrombocytopenia, respectively.

Dipyridamole (100 mg/kg) given orally was not effective, but oral administration of indomethacin (10 mg/kg) resulted in a 70% ($P<0.05$) inhibition of the thrombocytopenia.

In view of the known properties of aspirin, phenylbutazone, sulphinpyrazone and indomethacin *in vitro* (Mustard & Packham, 1975; Flower & Vane, 1974) it would appear that the ability of these drugs to inhibit thrombocytopenia in the Arthus reaction is probably a reflection of their inhibitory activity towards the release reaction or prostaglandin synthesis, both of which would be stimulated by the interaction between platelets and antigen/antibody complexes.

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Pharmacokinetics of frusemide related to diuretic response

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Frusemide is a potent short-acting diuretic which inhibits ionic reabsorption from the ascending limb of the loop of Henle. Pharmacokinetic studies suggest that bioavailability of the drug after oral administration is approximately 50% of that after intravenous administration (Calesnich, Christensen & Richter, 1966; Kelly, Cutler, Forrey & Kempel, 1974; Beerman, Dalen, Lindstrom & Rosen, 1975). Despite the relationship between the plasma concentration of frusemide and urine and sodium flow rates (Rupp, 1974), the total diuretic response has been observed to be the same after oral or intravenous administration of equal doses of frusemide to normal subjects (Kelly *et al.*, 1973). This study has attempted to elucidate factors which might account for this observation.

Six healthy males were studied on three separate occasions after administration of frusemide (80 mg intravenously, procedure I), orally unstressed (procedure II) and orally 36 h after frusemide (80 mg orally) followed by a 20 mmol sodium and 160 mmol potassium diet (procedure III). Urine and blood samples were collected at frequent intervals for 5 h together with all urine passed over the subsequent 31 hours. Plasma and urinary frusemide was measured by the methods of Hajdu and Haussler (1964). Urine sodium and potassium were measured by flame photometry.

Following procedure I the plasma concentration of frusemide declined in a biexponential manner. The onset of diuresis was rapid and the half-life of the exponential decline in rate of sodium excretion was similar to that of the late phase of the plasma frusemide concentration curve. Thus there was a plasma concentration-response relationship for this phase. Urine clearance of frusemide was 60% of total clearance. In procedure II the mean peak plasma concentration occurred at 90 min and then declined exponentially. The rise and fall in the rate of sodium excretion paralleled that of plasma frusemide. The plasma concentration-response curve had a parallel shift to the right when the decay phase was compared to the absorption phase. The area under the plasma frusemide concentration-time curve after procedure 1 was twice that after procedure II. A similar ratio was found when comparing the total recovery of frusemide in the urine. After procedure III the mean peak plasma concentration occurred at 45 minutes. The rate of sodium excretion paralleled plasma concentration of frusemide but the plasma concentration-response curve was significantly shifted to the right in comparison to that after procedure II. The total diuretic response in the first 5 h in terms of urine volume and sodium and potassium excretion were similar after oral and intravenous administration, but there were significant decreases in urine volume (28%; $P<0.01$) and sodium excretion (27%; $P<0.01$) after oral administration to sodium deprived subjects.

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The original observation that, despite a decreased bioavailability of frusemide after oral administration the total diuretic response is similar to that following intravenous administration is confirmed. The response to frusemide is related to drug present in the tissue compartment and can be modified by changes in sodium status.

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Gradients of monoamine levels in guinea-pig isolated ileum

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The function of each region of the gut differs, probably in relation to differences in innervation which have been demonstrated histologically (Maslennikova, 1962; Gillespie & Maxwell, 1971) and pharmacologically (Bennett & Stockley, 1975). Levels of some monoamines which may control gut motility were measured in the present experiments. Adult albino guinea-pigs of either sex (500–850 g body weight) were killed by stunning and bleeding, and the abdomen was opened. The ileal tissue was removed, cleared of fat and mesentery and divided into six approximately equal lengths. They were

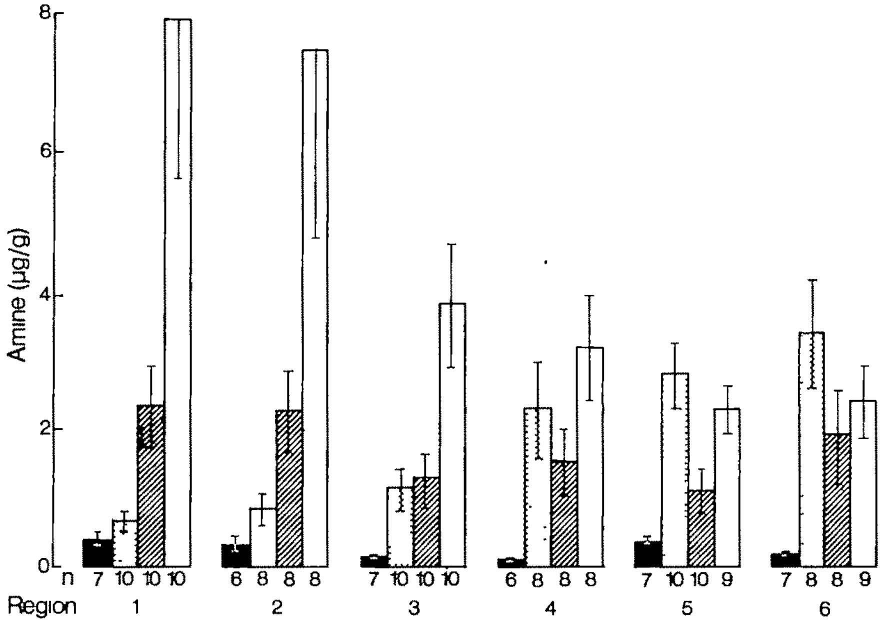

Figure 1 Levels of monoamines in different regions of guinea-pig ileal tissue. The histogram represents levels (μg amine ± s.e. mean/g wet weight) of adrenaline (filled columns), noradrenaline (stippled columns), dopamine (hatched columns) and 5-HT)open columns) in consecutive parts of ileum, each approximately 1/6th of total Region 1 is proximal, 6 is distal. The number of tissues is shown under each column. Levels of 5-HT decreased down the intestine ($r=0.974$, $P<0.001$) and norarenaline increased ($r=0.924$, $P<0.01$). Adrenaline and dopamine showed no significant trend ($r=0.526$ and 0.549 respectively).

opened and the mucosal surface carefully washed with water and blotted. The segments were then immersed in liquid nitrogen, weighed and homogenized in ice-cold acid butanol. Noradrenaline (NA), adrenaline (AD), dopamine (DA), and 5-hydroxytryptamine (5-HT) were extracted, and estimated fluorimetrically after trihydroxyindole formation (Ansell & Beeson, 1968, with the following modification by I.M. Martin, M.R.C. Neuropharmacology Research Unit, Medical School, Birmingham; personal communication). The supernatant from each homogenate was extracted with 10 ml iso-octane and 5 ml water. The aqueous phase (4.5 ml) was removed by a pipette pushed through the upper layer; no material at the interface was removed. This sample was processed as in the original method, but catecholamines were eluted from alumina with phosphate buffer pH 6.5 instead of acetic acid. Trihydroxyindoles were formed using 0.1 ml iodine reagent, 0.2 ml alkaline sulphate and 0.2 ml 6M acetic acid instead of the original quantities. AD was measured by Chang's (1964) method.

5-HT levels decreased aborally whereas NA levels increased (linear correlation coefficient, $P < 0.01$ and 0.001 respectively). DA and AD did not change significantly ($P > 0.1$) (Figure 1). 5-HT stimulates peristalsis in guinea-pig small intestine (Bülbring & Lin, 1958) whereas NA inhibits motility. Although the source of the amines (muscles, mucosa, blood vessels and nerves) is not known, these results are consistent with the finding that intestinal propulsion is more rapid proximally than distally.

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Investigation of the effects of drugs on morphine-induced contractions of the isolated colon of the rat

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Morphine causes some smooth muscle-containing tissue to contract (Weinstock, 1971). Whether or not morphine causes contractions depends on the dose, species and tissue examined (Vaughan Williams, 1954). In dog intestine, morphine produces contractions indirectly by releasing 5-hydroxytryptamine (5-HT) and acetylcholine (ACh) (Burks, 1973). This study sought to determine whether morphine had a similar effect in rat intestine. The effects of morphine were investigated by adding the drug to an organ bath containing 3–4 cm lengths of terminal colon suspended in oxygenated Krebs bicarbonate solution at 37°C. Responses of the colon were recorded isometrically.

Morphine (10^{-5} M) produced an immediate contraction followed at approximately minute intervals by waves of contractions, which gradually decreased in amplitude. When the tissue had ceased responding to the first dose of morphine, addition of a second dose was less effective in causing contractions. Prior addition of naloxone (5×10^{-6} M) to the bath prevented morphine producing contractions but naloxone (5×10^{-6} M) added after rhythmic activity had been initiated by morphine, was less effective in inhibiting the contractions. Morphine-induced contractions were not inhibited by atropine (10^{-4} M), hexamethonium (10^{-4} M) or tubocurarine (10^{-4} M). Indeed, these drugs occasionally potentiated morphine-induced contractions. Unlike in dog intestine, the responses produced by morphine in rat colon were dissimilar from those produced by ACh or 5-HT. The effects of 5-HT antagonists on the morphine-induced contractions were complex. Thus, lysergic acid diethylamide (3×10^{-7} M) did not affect the morphine-induced contractions but when administered alone, caused contractions similar to those produced by morphine. In contrast, cyproheptadine (3×10^{-5} M) not only abolished morphine-induced contractions but also inhibited responses to carbachol (10^{-7} M) and potassium (30 mM).

Morphine-induced contractions were potentiated by phentolamine (10^{-5} M) and inhibited by noradrenaline (5×10^{-7} M) or tyramine (3×10^{-5} M). The dose of morphine required to produce contractions was lower in tissue from rats pretreated with reserpine (0.3 mg/kg daily for three days). In these tissues in which the frequency of spontaneous contraction was increased, tyramine (10^{-5} M) did not inhibit morphine-induced contractions.

Morphine-induced contractions were inhibited by adenosine (5×10^{-6} M), adenosinetriphosphate (ATP) (5×10^{-6} M), papaverine (5×10^{-5} M) and by removing calcium from the bathing medium, but were unaffected by tetrodotoxin (3×10^{-7} g/ml), which caused contractions similar to those produced by morphine.

These results suggest the mechanism underlying the actions of morphine in rat colon is unlike that responsible for the actions of morphine in dog intestine (Burks, 1973). They suggest that morphine may cause contractions in rat colon by removing a tonic inhibitory nervous influence, which normally suppresses myogenic activity involving a pacemaker (Connor, Prosser & Weems, 1974) within smooth muscle (Wood, 1972; Tonini, Leccinini & Crema, 1974).

M.G.C.G. is an M.R.C. Scholar.

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Increased cerebral cyclic GMP concentration induced by muscarinic cholinergic agonists and prostaglandin $F_{2\alpha}$

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An important role for cyclic nucleotides in the functioning of the central nervous system has been indicated by a number of investigations (see Daly, 1975). In previous studies in this laboratory the use of the neonate chick with its immature blood-brain barrier has allowed the investigation of the effects of several neurohormones on cerebral cyclic AMP formation *in vivo* (Edwards, Nahorski & Rogers, 1974). In view of the growing evidence that cyclic GMP may also be involved in the processes of neurotransmission (Goldberg, O'Dea & Maddox, 1973), we have made appropriate studies on the nucleotide using the above experimental model.

All experiments were performed on 3-day old male Ranger chicks. Drugs were injected into the right jugular vein and at appropriate intervals the cerebral hemispheres were removed by a freeze-blowing apparatus (Veech, Harris, Veloso & Veech, 1973). Cyclic GMP was assayed, after chromatographic purification with alumina and Dowex 50 resin, by a modification of the protein binding method of Dinnendahl (1974).

Unlike cyclic AMP (Nahorski, Rees & Rogers, 1975) the concentration of cyclic GMP (50–70 pmol/g) in the cerebral hemispheres was not influenced by decapitation or by age over the perinatal period. The administration of oxotremorine, arecoline or methacholine (0.1–0.5 μmol/kg) induced a rapid increase in cyclic GMP concentration. Maximum increases (100–200%) were observed 3 min after injection. Of a number of other substances studied prostaglandin $F_{2\alpha}$ (0.5 μmol/kg was also effective in increasing (80–100%) the nucleotide concentration *in vivo*. However, noradrenaline, dopamine, 5-hydroxytryptamine, adrenaline, isoprenaline, clonidine, histamine, γ-aminobutyric acid and prostaglandin E_1 were found to be ineffective, in doses up to those producing marked behavioural effects.

Further *in vitro* studies of the effects of muscarinic agonists were made. Slices of chick cerebral hemispheres were pre-incubated for 30 min in Krebs-bicarbonate buffer. In the presence of the potent phosphodiesterase inhibitor papaverine (0.05 mM) the concentration of cyclic GMP in the slices (12–14 pmol/mg protein) was 2-fold higher than in its absence. Moreover exposure to oxotremorine (10 µM) produced a further increase of 100% in cyclic GMP only in the presence of papaverine.

From these results it is clear that the factors regulating cerebral cyclic GMP concentration differ from those controlling cyclic AMP. These initial studies show that in chick cerebral tissue, muscarinic agonists and prostaglandin $F_{2\alpha}$ stimulate cyclic GMP formation, but whether or not these effects result from the direct stimulation of cell surface receptors remains to be established.

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The effect of chronic lithium administration on stimulation-induced changes in forebrain 5-hydroxyindoles: modification by chlorimipramine

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Collard & Roberts (1974) showed that chlorimipramine reduced the production of 5-hydroxyindoleacetic acid (5-HIAA) by stimulation of the medial raphe nucleus, probably by inhibiting reuptake of neuronally released 5-hydroxytryptamine (5-HT). Using this method of examining 5-HT release this study reports the effect of lithium (Li^+).

Male Albino Wistar rats weighing 150–250 g were divided into two groups of 36 animals. One group received a daily injection of isotonic (0.15 M) LiCl (0.75 mEq/kg i.p.) for 10 days while the control group received saline. Twenty-four hours after the last dose of Li^+ or saline, half the animals in each group received chlorimipramine (5 mg/kg i.p.), while the others received saline. From each of the four

Table 1 The effect of chlorimipramine (5 mg/kg i.p.) on the stimulation-induced changes in forebrain 5-hydroxyindole concentrations in control animals and in animals which had received 10 day Li^+ treatment. Results are expressed as the mean ± s.e. mean of 9 pairs of animals and analysed by the paired t test. (+ and – indicate stimulation-induced increases and decreases, respectively in 5-hydroxyindole concentration).

Stimulation-induced change in 5-HT concentration (ng/g)

	Saline	*Chlorimipramine*	*Chlorimipramine minus saline*	*P*
Control	+44 ± 53	+116 ± 59	+72 ± 99	n.s.
Lithium	+71 ± 50	–42 ± 51	–113 ± 48	0.05

Stimulation-induced change in 5-HIAA concentration (ng/g)

	Saline	*Chlorimipramine*	*Chlorimipramine minus saline*	*P*
Control	+93 ± 12	–16 ± 15	–109 ± 20	0.001
Lithium	+98 ± 21	+78 ± 14	–20 ± 22	n.s.

subgroups, paired animals received raphe stimulation or sham treatment (Collard & Roberts, 1974).

Results are expressed as the difference between unstimulated and stimulated animals (Table 1). This difference does not appear to reflect drug induced changes in 5-hydroxyindole levels of unstimulated animals. Only the combination of Li$^+$ and chlorimipramine significantly altered changes in 5-HT levels, but Li$^+$ abolished the effect of chlorimipramine on 5-HIAA.

The reduction of 5-HIAA by chlorimipramine alone may indicate that the 5-HIAA produced by raphe stimulation arises predominantly from the metabolism of extraneuronally released 5-HT. Chlorimipramine by inhibiting uptake would deny released 5-HT access to intraneuronal monoamine oxidase and reduce the production of 5-HIAA.

Preliminary studies have indicated that Li$^+$ does not antagonize the inhibition of uptake by chlorimipramine. The lack of effect of chlorimipramine on the increase in 5-HIAA concentration in the Li$^+$ group suggests therefore that the 5-HIAA is produced primarily from 5-HT which remains intracellular. Since stored 5-HT is believed to be protected from deamination, the results may imply that Li$^+$ inhibits the extraneuronal release of 5-HT by promoting the release of 5-HT into the cytoplasm.

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The individual and combined effects of hypothermia and reserpine pretreatment on the rate and tension responses to isoprenaline and salbutamol in guinea-pig atria

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The dose-response curves for the positive inotropic and chronotropic effects on the heart of sympathomimetic amines have been shown to be displaced to the left by hypothermia, indicating supersensitivity (Trendelenburg, 1968; Reinhardt, Wagner & Schumann, 1972). Reserpine pretreatment has also been shown to produce supersensitivity of the rate (Taylor, Westfall & Fleming, 1974), and tension (McNeill & Shulze, 1972) responses, together with an increase in the maximum responses of the partial agonist salbutamol (Broadley & Lumley, 1975). We were therefore interested to determine the individual and combined effects of hypothermia and reserpine pretreatment upon the rate and tension dose response curves to isoprenaline and salbutamol, and whether the maximum response to the latter was also enhanced by hypothermia.

Separated left and right guinea-pig atria were suspended in Krebs bicarbonate solution (50 ml) initially at 38°C, and gassed with CO_2:O_2 (5%:95%). The left atrium was paced electrically at 2 Hz and isometric tension recorded on a Devices M19 polygraph for the inotropic responses. Chronotropic responses were obtained by means of a ratemeter triggered by the isometric tension signal of the spontaneous right atrium. An initial cumulative dose-response curve to isoprenaline was obtained at 38°; 30°; or 25°C. A third curve to salbutamol at the same temperature was compared with the second isoprenaline curve corrected for loss in sensitivity, from control experiments. Increase rate and increase tension responses were plotted as a percentage of the isoprenaline maximum response. Results are expressed as ng/50 ml to produce 50% of the maximal response.

The rate dose response curve to isoprenaline (60.2 ± 7.6) at 38°C lay to the left of the tension curve (354.4 ± 86.4). On cooling the preparation to 30°C both rate and tension curves were displaced to the left, tension to a greater extent, and the curves became virtually superimposable (Rate 23.57 ± 4.9; Tension 26.0 ± 2.5). Cooling to 25°C resulted in a further shift, and the tension curve now lay to the left of rate (Rate 8.75 ± 2.2; Tension 6.1 ± 1.7). The salbutamol curves were similarly displaced to the left by cooling, and their maxima were progressively raised from 61.2 ± 6.5 and 21.6 ± 11.3 at 38°C, to 75.2 ± 12.0 and 56.0 ± 15.6 at 30°C, and to 86.6 ± 7.1 and 66.3% ± 17.8 at 25° for rate and tension respectively.

In atria from guinea-pigs pretreated with reserpine (5 mg/kg i.p. at 72 h and 3 mg/kg i.p. at 48 and 24 h before sacrifice) supersensitivity was demonstrated at 38°C by a shift of the dose response curves to isoprenaline to the left. Tension was potentiated more than rate as shown by their respective ED_{50} values of 46.2 ± 7.1 and 18.8 ± 3.3. At 30°C, reserpine-induced supersensitivity occurred in excess of that already induced by the hypothermia but, at 25 °C was minimal and no longer significant.

The dose response curves to salbutamol at each temperature were displaced to the left by reserpinization and their maxima were also raised. In contrast to isoprenaline, reserpine was still apparently able to produce supersensitivity to salbutamol at 25°C, by increasing its maximum response from 73.8 ± 10.8 and 55.7 ± 20.1 at 38°C to 93.9 ± 13.8 and 77.3% ± 12.8 at 25°C for rate and tension respectively.

This study demonstrates a supersensitivity of the rate and tension responses to isoprenaline and the partial agonist salbutamol by both hypothermia and reserpinization, with a trend towards full agonist activity of the latter.

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Peripheral vascular effects of clonidine independent of a reduction in sympathetic activity

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Clonidine is a powerful drug and can produce a wide range of effects depending on the dose and route of administration. For example, when the drug is given to animals parenterally in large doses, or is administered locally into the cisterna magna, the lateral cerebral ventricle or the vertebral artery, a variety of central nervous system effects can be produced. Because of this, the assumption that the hypotensive effect of clonidine results only from a central action underlies a great many statements made during the past few years (Schmitt, Schmitt, Boissier & Giudicelli, 1967; Klupp, Knappen, Otsuka, Streller & Teichmann, 1970).

When clonidine is administered orally to cats in daily doses similar to those used clinically, it reduces both the magnitude and the duration of vasoconstrictor and vasodilator responses elicited either by the electrical stimulation of the lumbar sympathetic chain, or by the close-arterial administration of vasoconstrictor and vasodilator drugs. It appears, therefore, that, with doses below 10 μg/kg, the hypotensive action of the drug is the result of a vascular smooth muscle change and not of a central nervous system effect (Zaimis, 1969; Larbi, 1970; Zaimis, 1974). The present findings lend further support to clonidine having a direct action on vascular smooth muscle.

Eight cats were anaesthetized with a mixture of chloralose and pentobarbitone sodium, atropinized and artificially ventilated after the administration of gallamine triethiodide. The arterial blood pressure, electrocardiogram and left femoral blood flow of each animal were recorded on a Grass P7 polygraph. The third thoracic ramus communicans was exposed where it enters the stellate ganglion, cut distally and dissected into small filaments until impulse activity from a single fibre or from a few fibres only could be recorded. The central stump of the cut right femoral nerve was stimulated and cardiovascular responses as well as changes in sympathetic discharge were measured. Changes in sympathetic discharge were also induced by increasing or decreasing blood pressure in the carotid sinuses. For inducing blood flow changes at various frequencies of stimulation an electrode was placed on the left lumbar sympathetic trunk and the nerve ligated centrally to the electrode.

After a number of control measurements of baseline activity and evoked responses, clonidine was infused for 60 min at a rate of 0.1 µg/min, this being supplemented by a single additional injection sufficient to bring the total i.v. dose administered to 3.0 µg/kg. At this dose level, clonidine always reduced the local vasoconstriction induced by lumbar sympathetic stimulation; the reflex pressor response to afferent femoral stimulation was also clearly decreased. In contrast, spontaneous and evoked sympathetic activity remained almost unchanged and in several instances the drug exerted clear-cut haemodynamic effects when sympathetic activity was entirely unaffected. It is concluded that clonidine can affect the circulation by an action independent of any depressant effect on sympathetic discharge.

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The cardiovascular effects of clonidine in rabbits after cervical spinal cord transection

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The hypotension and bradycardia produced by clonidine appear to be mediated by a central action of the drug, causing a reduction in peripheral sympathetic discharges (Schmitt, Schmitt, Boissier, Giudicelli & Fichelle, 1968) and facilitation of vagally mediated cardiodepressor reflexes (Kobinger & Walland, 1972). We have investigated the contributions of increased vagal tone and sympathetic withdrawal to the action of clonidine following spinal cord transection under pentobarbitone anaesthesia at the level of the sixth cervical vertebra. Transection at this level leaves vagal outflow and spinal reflex activity intact, but interrupts bulbospinal pathways modulating sympathetic outflow. Clonidine (30 or 100 µg/kg) was administered into the marginal ear vein of conscious rabbits before, 1 h, 24 h and 7 days after transection. Mean arterial pressure (MAP) was recorded directly from the central artery of the ear.

Before transection, the MAP and heart rate were 79.5 ± 2.6 mmHg and 207.0 ± 10.2 beats/min (mean ± s.e. mean, $n = 8$). Clonidine (30 µg/kg) caused an initial pressor response (+16.8 ± 2.3 mmHg) lasting less than a minute. This was followed by prolonged hypotension. MAP fell to 66.1 ± 3.0 mmHg at 10 min and returned to control after 40 minutes. Bradycardia (−102.5 ± 8.7 beats/min) accompanied the pressor effect and lasted 30 minutes.

One hour after spinal transection, the MAP had fallen to 47.6 ± 5.0 mmHg, due to loss of sympathetic tone, since there was no significant change in heart rate. Clonidine caused a significantly greater pressor effect (+26.3 ± 3.2 mmHg) which persisted for 5 min and the fall in MAP was completely abolished. Bradycardia still occurred but was less (−63.1 ± 16.0 beats/min). Twenty-four hours after transection, the MAP was not significantly different from pre-operative control. At both 24 h and 7 days the pressor action of clonidine (30 µg/kg) was increased (+33.5 ± 2.1 and 26.3 ± 4.4 mmHg respectively) and lasted for 20 minutes. Bradycardia was present but MAP did not fall.

Similar results were obtained in a further group of rabbits after clonidine 100 µg/kg. Once again at no time after transection was a hypotensive effect of the drug observed. Intracisternal injection of clonidine (1 µg/kg) reduced MAP by 38.0 mmHg in intact pentobarbitone anaesthetized rabbits. In animals examined 7 days after transection, intracisternal clonidine had no hypotensive effect.

These results confirm that the principal site of hypotensive action of clonidine is in the central nervous system. Hypotension results from withdrawal of sympathetic tone rather than vagal facilitation as in transected rabbits vagally mediated bradycardia still occurred but blood pressure did not fall. Heart rate changes result predominantly from vagal mechanisms, although sympathetic withdrawal may contribute. The potentiation and prolongation of the pressor effect may represent the effect on peripheral α-adrenoceptors unopposed by a central hypotensive action.

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Pressor responses to noradrenaline administered into the third cerebral ventricle of anaesthetized and conscious cats

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Administration of noradrenaline into a lateral cerebral ventricle has been reported to cause falls in blood pressure in both anaesthetized (Nashold, Mannarino & Wunderlich, 1962) and conscious (Day & Roach, 1974) cats. However, pressor responses have been observed after noradrenaline administration into the third ventricle (Phillippu, Przuntek, Heyd & Burger, 1971) and after the administration of low doses of noradrenaline into the lateral ventricles of anaesthetized cats (Gagnon & Melville, 1966).

In the present study we have infused noradrenaline into the third ventricle of both anaesthetized and conscious cats and have recorded the effects on blood pressure and heart rate. Blood pressure was recorded from a femoral artery in anaesthetized (chloralose 70 mg/kg i.v.) animals and from an indwelling carotid catheter in conscious animals. Heart rate was obtained from the blood pressure pulse. In both series of experiments cannulae were inserted stereotaxically into the third ventricle.

The administration of noradrenaline (15 and 30 µg) into the third ventricle of 12 anaesthetized cats produced mean (± s.e. mean) pressor responses of 56.0 ± 13.4 and 80.3 ± 12.4 mmHg systolic and 42.0 ± 11.8 and 56.9 ± 9.0 mmHg diastolic, respectively, with a variable effect on heart rate. The duration of the pressor response was usually 10 to 20 minutes. In seven experiments spinal section at C-2 was performed and in five of these the response to noradrenaline was significantly ($P < 0.05$) reduced, whilst in the remaining two a potentiation was seen. In 6 cats bilateral adrenalectomy significantly ($P < 0.05$) reduced the pressor response to noradrenaline administered into the third ventricle whilst in three other cats the response was potentiated. Responses to systemic noradrenaline (0.25 to 1 µg/kg i.v.) were not affected by either adrenalectomy or spinal section.

In conscious cats lower doses of noradrenaline (1.65 to 10 µg) produced pressor responses when infused into the third ventricle. These responses were usually associated with tachycardia, and both pressor and heart rate responses were markedly reduced after hexamethonium (1 to 10 mg/kg i.v.) indicating that they were of central origin. Propranolol (0.5 to 1 mg) infused into the third ventricle of 4 cats reduced by approximately 60% the pressor response and tachycardia to noradrenaline administered by the same route. Phentolamine (0.5 mg) infused into the third ventricle of 3 cats reduced the noradrenaline pressor response by approximately 45%.

The results suggest that noradrenaline administered into the third cerebral ventricle of cats can produce a centrally-mediated pressor response which is apparently the result of stimulation of both α and β adrenoceptors and which in some cats is partly due to central activation of the adrenal medulla.

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Beta adrenoceptors in the hepatic arterial vascular bed of the dog

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It has previously been shown that intra-arterial injections of noradrenaline cause vasoconstriction in the hepatic arterial vascular bed of the dog (Richardson & Withrington, 1975; 1976). The present communication describes a vasodilator response of the same vasculature to the intra-arterial injection of isoprenaline. The receptors responsible for this effect have been characterized using the nonselective β-adrenoceptor antagonist propranolol (Inderal, ICI), the selective β_1-adrenoceptor antagonist atenolol (ICI 66082, Tenormin; Hainsworth, Karim & Stoker, 1974), and the selective β_2-adrenoceptor agonist salbutamol (Ventolin, Allen & Hanburys; Daly, Farmer & Levy, 1971).

Eight dogs (12.3–17.5 kg) were anaesthetized with chloralose (Kuhlmann, Paris; 50 mg/kg) and urethane (BDH; 500 mg/kg i.v.), after induction with methohexitone sodium (Brietal, Lilly; 7.5–10.0 mg/kg, i.v.). The hepatic artery was dissected away from its periarterial sympathetic nerves, cannulated close to its origin from the aorta, and perfused with blood from a cannulated femoral artery. The hepatic arterial mean perfusion pressure (PP) was measured close to the cannula in the hepatic artery, and the blood flow in this system (hepatic arterial blood flow, HABF) measured with a cannulated flow probe and electromagnetic flowmeter. Since these experiments were to investigate vasodilatation, the sympathetic nerves were left intact to ensure a basal tone.

The control values (mean ± s.e. mean were: for PP, 125.6 ± 7.4 mmHg, and for HABF, 219.5 ± 14.1 ml/minute. The calculated hepatic arterial vascular resistance (HAVR) was 0.59 ± 0.06 mmHg ml^{-1} min, or 1.81 ± 0.18 mmHg ml^{-1} min 100 g, the livers weighing 316.8 ± 77.1 (s.d.) g *post mortem*.

Isoprenaline sulphate (Macarthys) was injected intra-arterially in doses from 0.01 to 100 µg, and graded reductions in HAVR obtained up to a maximum of 38.1 ± 2.3% ($n = 8$).

Propranolol (100 µg/kg, i.v.) antagonized the chronotropic responses to i.v. isoprenaline (5 µg) and caused a marked, parallel shift of the dose-response curve of i.a. isoprenaline on the hepatic arterial vascular bed to the right without suppression of the maximum response (two experiments). Atenolol (100 µg/kg, i.v.) although blocking the chronotropic actions of isoprenaline (5 µg, i.v.), in contrast to propranolol caused no change in the position or shape of the dose-response curve to i.a. isoprenaline on the hepatic arterial vascular bed.

In further experiments, paired doses of isoprenaline and salbutamol were injected into the hepatic artery. It was evident that at equimolar doses, isoprenaline was always the more potent, though the maximum reduction in HAVR was the same for each. The maximum fall in HAVR for isoprenaline was 38.1 ± 2.3% and the ED_{50} was 6.3×10^{-10} mol, whilst the corresponding values for salbutamol were 38.1 ± 3.5% and 3.5×10^{-9} mol ($n = 3$).

The results suggest that the adrenoceptors mediating hepatic arterial vasodilatation in the dog are predominantly of the β_2 type, and, furthermore, that isoprenaline is intrinsically a more potent stimulant of these receptors than salbutamol.

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Structure activity studies on dopamine receptors; a comparison between rat striatal adenylate cyclase and *Helix aspersa* neurones

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We have previously shown that certain neurones of the snail *Helix aspersa* are inhibited by dopamine; this effect is mediated by specific dopamine receptors (Woodruff & Walker, 1969; Woodruff, 1971). These results were confirmed by Struyker Boudier, Gielien, Cools & Van Rossum (1974) who also compared the dopamine receptors mediating inhibition with those causing excitation of other *Helix* neurones. The present study compares the structural requirements of the dopamine sensitive striatal adenylate cyclase with those previously determined on snail neurones.

The potency of each agonist in increasing cyclic AMP production in rat striatal homogenates was determined by the method of Kebabian, Petzold & Greengard (1972) and the resulting cyclic AMP measured according to Gilman (1970). Potency was expressed as a percentage of the maximum response produced by 100 μM dopamine. A log dose/response curve was constructed for each agonist from which the ED_{50} values were obtained.

In the absence of dopamine the mean production of cyclic AMP by 50 μl striatal homogenate was 36.3 ± 2.08 (21) p moles/tube. This was increased to 100.5 ± 5.4 (23) by 100 μM dopamine. The potency of various phenylethylamine derivatives as agonists on the striatal adenyl cyclase and on snail neurones are shown in Table 1.

The dopamine analogue 2-amino-6,7-dihydroxy-1,2,3,4-tetrahydronaphthalene (ADTN) mimicked both inhibitory and excitatory actions of dopamine in the snail brain and was equipotent with dopamine in increasing cyclic AMP production. Ergometrine, a potent antagonist on snail neurones, was a partial agonist on the adenylate cyclase system causing a maximal stimulation of 63% at 10 μM.

These results demonstrate that there is a close similarity between the structural requirements for dopamine-like activity in rat striatum and snail neurones.

Table 1 The activity of drugs on rat striatal adenylate cyclase and *Helix aspersa* neurones

	ADENYLATE CYCLASE		*HELIX NEURONES*
Agonist	*ED_{50} (μM)*	*Equipotent Molar Ratio (ED_{50} agonist/ED_{50} dopamine)*	*Equipotent Molar Ratio (from Woodruff & Walker, 1969)*
Dopamine	3.2 ± 1.0*	1	1
Epinine	3.4 ± 0.5	0 94*	1
(−)-Noradrenaline	76.0 ± 15.8	24*	25
3,4-dihydroxy-5-methoxy phenylethylamine	96.0 ± 13.9	30	17
(−)-Adrenaline	201.0 ± 14.1	63	92
(±)-Isoprenaline	inactive	Inactive*	inactive
(−)-Phenylephrine	Inactive	Inactive	Inactive
3,5-dihydroxy-4-methoxy phenylethylamine	Inactive	inactive	Inactive
3-hydroxy-4,5-dimethoxy phenylethylamine	Inactive	inactive	Inactive

Values are the mean ± s.e. mean obtained from 4–8 observations.
All active compounds gave 100% stimulation.
* Similar values were obtained by Miller, Horn, Iversen & Pinder (1974) for these compounds.

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Contractile properties of hypertrophied and normal rat hearts

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Conflicting reports of contractility changes associated with cardiac hypertrophy are found in the literature. An unchanged (Grimm, Kubota & Whitehorn, 1963) reduced (Spann, Buccino, Sonnenblick & Braunwald, 1967) or increased (Kerr, Winterberger & Giambattista, 1961) contractility has been observed. We have compared the performance *in vitro* of hearts from hypertensive and normal rats to establish whether or not cardiac hypertrophy is associated with reduced contractility.

Renal hypertension was induced in male Wistar rats ($n=40$) according to the method of Finch & Leach (1970). A control group ($n=40$) consisted of unilaterally nephrectomized and sham-operated rats. At 5 weeks the mean systolic blood pressures, as measured by the tail cuff technique, were: controls 142.1 ± 4.2 mmHg, hypertensives 226.9 ± 6.0 mmHg (1 mmHg$\simeq$133 Pa). Rats were designated 'hypertensive' and included in the study only if their blood pressures were $>$control$+3$ standard deviations. The animals were killed by cervical fracture, the hearts removed and perfused with McEwens (1951) solution at 37°C gassed with O_2/CO_2 (95:5) according to a modified Langendorff technique described by Broadley (1970). Recordings of isometric developed tension were made by the method of Beckett (1970) using a Grass FT03C force-displacement transducer in conjunction with a Devices M19 recorder. The S-A node was destroyed and the hearts paced using bipolar platinum electrodes delivering rectangular pulses of 2.0 ms duration and 2.5 V from a Devices stimulator.

Force-frequency relationships of the 2 groups were examined over heart rates of 270–500 bts/min at a diastolic tension of 2 grams. The relationship between diastolic tension (0.25–20 g) and developed systolic tension was studied in hearts paced at 275 bts/min and the sensitivity of each group to the positive inotropic effects of $CaCl_2$ were studied in hearts paced at 275 bts/min with a diastolic tension of 2 grams. Finally, the hearts were removed from the perfusion apparatus and weighed. Mean dry weights of each group were: controls, 0.189 ± 0.007 g; 'hypertensives' 0.300 ± 0.017 grams. Water content was 81% in each case.

In the above procedures, tension developed by the hypertrophied hearts was less ($P<0.05$) than controls either per gram diastolic tension, per bt/min or per equivalent dose of $CaCl_2$. However, if in the force-tension experiments diastolic tension was expressed per gram heart weight and developed tensions in the remaining two procedures, expressed as a percentage initial control tension, there was no difference between the performances of the two groups.

To investigate further this apparent relationship between heart weight and contractile performance, the same procedures were repeated using hearts from normal rats ranging in weight from 70 to 550 grams. Dry heart weight range was 0.068 ± 0.003 g to 0.309 ± 0.012 grams. On this basis, the hypertrophied hearts did not show a reduced performance compared with hearts of similar weights derived from normotensive rats.

We conclude that pressure overload induced cardiac hypertrophy in rats need not be associated with reduced contractility, but that the apparently reduced cardiac performance is similar to that of hearts of similar size from normal animals and is related to heart weight.

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Motor transmission in the vas deferens of guanethidine-treated guinea-pigs

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There are reasons to believe that motor transmission to the longitudinal muscle of guinea-pig vas deferens is non-adrenergic (Ambache & Zar, 1971; Euler & Hedqvist, 1975). Recently, Furness (1974) has advanced fresh evidence against this view. He has found a great reduction in the nerve-mediated contractions of the vas deferens from guanethidine-treated guinea-pigs; the attenuated contractions were restored to normal levels by exposing the isolated preparation first to (+)-amphetamine (DA) and then to noradrenaline (NA). He has interpreted these results to indicate that NA is the motor transmitter in this tissue.

The present experiments were carried out to determine whether or not repletion by exogenous NA of depleted NA stores was an essential pre-requisite for the restoration of nerve mediated responses in the vas deferens.

Vasa from guanethidine-treated guinea-pigs (100 mg/kg, i.p., 24 h earlier) were set up in 10 ml. organ baths in Krebs; contractions on electrical field stimulation (5 pulse-trains, 1 ms, 10 Hz, 12 V, once every min.) were recorded isometrically. The preparations were exposed first to DA, 1 μg/ml for 15 min, then to NA, 0.5 μg/ml for 6 minutes. Twenty minutes after NA-wash-out, DA, 1 μg/ml was re-introduced into the bath. In control contralateral vas, exposure to NA was omitted.

In all experiments ($n=7$) nerve-mediated contractions were virtually completely lost; restoration of the responses, after exposure for 15 min to DA and 6 min to NA was partial ($8.4 \pm 1.7\%$) and substantially lower than in control (NA-untreated) contralateral preparations ($33 \pm 3\%$). Longer exposure to DA (> 90 min) was needed for complete recovery. There was no evidence that treatment with NA facilitated recovery.

In 3 experiments on vasa from guinea-pigs treated 24 h earlier with (–)-β-hydroxyphenethylguanidine (100 mg/kg, i.p.), a more potent agent than guanethidine in depleting NA stores (Fielden & Green, 1967), motor transmission persisted unimpaired.

Histochemical examination of the vasa from guanethidine or (–)-β-hydroxyphenethylguanidine-treated animals showed a total lack of catecholamine fluorescence. Catecholamine fluorescence was missing in vasa from guanethidine-treated animals even after complete recovery of motor transmission on prolonged exposure to DA.

These findings do not lend support to Furness's conclusion (1974) that the reversal of guanethidine-induced block of motor transmission in the vas deferens was dependent upon the repletion of NA-stores and therefore the transmission was adrenergic. The lack of correlation between NA-depletion and motor blockade is consistent with the non-adrenergic nature of motor transmission in this organ.

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Further studies on the depressant action of tetracyclines plus ascorbic acid on the rabbit ear artery

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We have described previously (McCullough & Wallace, 1975) a depressant action on constrictor responses to noradrenaline and histamine of a mixture of oxytetracycline (10^{-4} mol/l) and ascorbic acid (1.1×10^{-3} mol/l) added to the perfusate of the isolated rabbit ear artery. In the present study this effect is examined in greater detail.

The depressant effect of the mixture was greater after 90 min prior incubation of the perfusate at 37°C than when the mixture had been made up immediately before perfusion began—61% reduction ($P < 0.01$) as compared with 24% reduction ($P < 0.05$) in responses to 10 ng noradrenaline.

Varying the concentration of oxytetracycline from 5×10^{-5} mol/l to 2×10^{-4} mol/l while holding the concentration of ascorbic acid constant at 1.1×10^{-3} mol/l had no appreciable effect on the depressant action of the mixture. However, when the oxytetracycline concentration was held constant at 10^{-4} mol/l the concentration of ascorbic acid was critical. At a concentration of 0.55×10^{-3} mol/l ascorbic acid the response to 10 ng noradrenaline was depressed by 46%, at 1.1×10^{-3} mol/l it was depressed by 61% and at 2.2×10^{-3} mol/l it was depressed by 90% ($P < 0.01$ in all cases).

When the oxytetracycline in the mixture was replaced by tetracycline, demethylchlortetracycline or minocycline (all 10^{-4} mol/l) the constrictor responses were significantly ($P < 0.02$) depressed in all cases; the extent of the depression was similar (60–80%) to that produced by oxytetracycline.

When the oxytetracycline was replaced by chloramphenicol or cloxacillin (10^{-4} mol/l) there was a significant ($P < 0.05$) inhibition of the constrictor responses but this inhibition was much less than that obtained with oxytetracycline (Figure 1) and similar to that produced by ascorbic acid alone (McCullough & Wallace, 1975). With streptomycin (10^{-4} mol/l) there was no significant effect on constrictor responses.

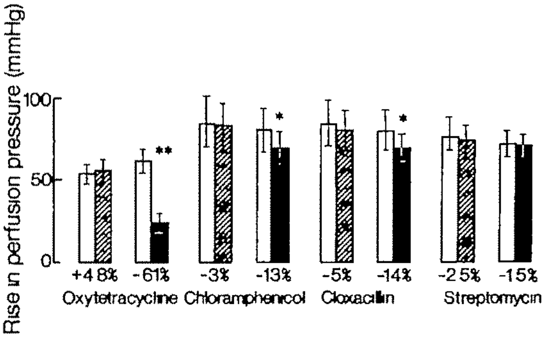

Figure 1 Effect of oxytetracycline, chloramphenicol, cloxacillin and streptomycin (all 10^{-4} mol/l) alone (hatched rectangles) and when mixed with ascorbic acid (1.1×10^{-3} mol/l) (black rectangles). (Open rectangles), control responses to noradrenaline 10 ng.

The results are means with standard errors from six experiments. ** $P < 0.01$, * $P < 0.05$; Paired t test; no other differences significant.

The results are consistent with the hypothesis that the depressant effect of the mixture is related to an interaction between the tetracycline and ascorbic acid in which the concentration of the ascorbic acid is the more critical, the tetracycline possibly playing a catalytic role.

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The effect of morphine on turning behaviour in rats and mice with unilateral 6-hydroxydopamine lesions

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The acute administration of morphine to rats alters dopamine metabolism in the striatum (Kuschinsky & Hornykiewicz, 1974) and results in an indirectly mediated inhibition of dopamine receptor activity (Lal, 1975). We have examined the action of morphine in rats with unilateral 6-hydroxydopamine (6-OHDA) lesions of the substantia nigra since (+)-amphetamine-induced rotation of these animals is used to investigate the effects of drugs on dopamine release in the brain. Female Sprague Dawley albino rats (150 g) were injected unilaterally with 6-OHDA (8 μg in 4 μl) into the left substantia nigra (co-ordinates: A +2.0 mm; L 1.6 mm; H −2.3 mm, Konig & Klippel, 1963). After 21 days, ipsilateral circling induced by (+)-amphetamine (5 mg/kg i.p.) in groups of 8 rats was recorded for 1 hour. Morphine (2 or 4 mg/kg i.p.) when administered 48 h later together with (+)-amphetamine, caused a statistically significant reduction in the turning. Morphine (2 mg/kg) reduced the mean turning rate recorded between 15 and 60 min after the amphetamine injection by 45% from 19.8 ± 1.0 turns/min to 10.9 ± 1.0 turns/min ($P < 0.001$). The higher dose of morphine (4 mg/kg) caused a 68% reduction in the mean turning rate from 22.7 ± 0.8 to 7.2 ± 1.1 turns/min ($P < 0.001$). The rate of contralateral circling induced by apomorphine (2.0 mg/kg) in groups of 8 nigral lesioned rats was counted. After 48 h morphine (2 or 4 mg/kg) was administered followed 15 min later by apomorphine. In contrast to the results with (+)-amphetamine, apomorphine turning was not affected by 2 mg/kg of morphine but there was a significant 18% reduction in the mean turning rate following a dose of 4 mg/kg of morphine ($P < 0.01$).

Lesions were also produced in adult rats (240 g) by injecting 6-OHDA (40 μg) into the left striatum (co-ordinates: A +8.5 mm; L 2.6 mm; H −1.0 mm). After 14–21 days groups of 8 such rats circled when given (+)-amphetamine (5 mg/kg). Morphine (4 mg/kg) reduced the mean turning rate by 71% from 22.1 ± 0.9 turns/min to 6.4 ± 0.8 turns/min ($P < 0.001$). When given a larger dose of morphine (8 mg/kg) the animals stopped turning completely. The reduction in (+)-amphetamine-induced turning was entirely prevented by naloxone (2 mg/kg i.p.). Levorphanol (6 mg/kg) totally suppressed (+)-amphetamine-induced turning whereas dextrorphan (6 mg/kg) had no effect.

We investigated the action of morphine on turning induced by (+)-amphetamine in albino mice lesioned by injection of 6-OHDA (10 μg) into the left striatum. (+)-Amphetamine (5 mg/kg) caused ipsilateral circling with a mean rate of 9.9 ± 0.9 turns/min ($n = 12$). Morphine (4 mg/kg) had no effect whatsoever on the rate of turning or the total number of turns made over 45 minutes.

The results are consistent with the hypothesis of Kuschinsky & Hornykiewicz (1974) that one effect of morphine in the rat is to reduce the release of dopamine in the striatum but that morphine does not apparently have the same action in the mouse.

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Effects of repeated doses of ketamine on sleeping times in rats

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Douglas & Dagirmanjian (1975) reported that repeated doses of ketamine at four day intervals produced tolerance in rats, exhibited as a decrease in sleeping time. In the experiments reported here, 25 male rats, initial body weight 88–135 g, were injected with ketamine (75 mg/kg i.p.) every fourth day for sixteen days. After each dose the sleeping time was measured as the time elapsed between the loss and regaining of the righting reflex and 5 rats were killed by decapitation at the point of recovery. Mixed venous and arterial blood samples were collected in heparinized tubes, and centrifuged to obtain plasma which was then frozen for assay. The samples were extracted and assayed for ketamine and its metabolites by gas-liquid chromatography according to the method of Chang & Glazko (1972). Standard solutions of ketamine, its *n*-demethylated metabolite (I) and the subsequent oxidation product (II) were used to produce standard assay curves.

Unlike the findings of Douglas & Dagirmanjian (1975) there was no significant decrease in mean sleeping times with repeated doses (Table 1), although there was a tendency for them to decrease by day sixteen. The table also shows the plasma levels of ketamine and its metabolites at recovery and the significant fall in ketamine levels found appears to be balanced by the significant rise in metabolite II levels. The presence of relatively high levels of metabolite II directly contrasts with the results of Cohen, Chan, Way & Trevor (1973) and Cohen & Trevor (1974) who could find no evidence of this metabolite either *in vivo* or *in vitro* in rats.

A significant decrease in sleeping time in rats following repeated i.p. injections of ketamine could not be clearly demonstrated, but the presence of the cyclohexanone oxidation product has been demonstrated and its increase during the course of the experiments suggests that induction of the enzyme responsible for this degradation may have occurred.

Table 1 Effects of repeated i.p. doses of ketamine (75 mg/kg) on rats (means ± s.e. mean)

		Plasma levels at recovery (5 animals) (µg/ml)		
Days	*Sleeping time (min)*	*Ketamine*	*Met. I*	*Met. II*
1	16.60 ± 1.88 (25)	2.15 ± 0.23	0.93 ± 0.19	0.69 ± 0.11
4	18.97 ± 1.60 (20)	1 83 ± 0.06	0.90 ± 0.04	0.77 ± 0.08
8	18.94 ± 2.61 (15)	1.69 ± 0.25	0.83 ± 0.02	0.95 ± 0.08
12	14.76 ± 3.33 (10)	*1.46 ± 0.08	0.86 ± 0.05	*1 00 ± 0.05
16	8.40 ± 4.40 (5)	*1.35 ± 0 14	0.85 ± 0.02	0.80 ± 0.03

Number of rats in parentheses.
* Values significantly different from day 1 ($P < 0.05$).

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Desensitization of the rat aortic strip to vasopressin by infusions of noradrenaline

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Eden & Nasmyth (1974) showed that when noradrenaline (400 ng kg^{-1} min^{-1}) was perfused for 30 min through an organ bath containing a rat aortic strip bathed in Krebs solution, it desensitized the tissue to noradrenaline. In order to determine whether or not the desensitization was specific for noradrenaline, the experiment was repeated using vasopressin as the agonist.

Responses of the rat aortic strip to vasopressin (1.5–2.5 mU ml^{-1}) were established before and after perfusing the organ bath with noradrenaline (400 ng kg^{-1} min^{-1}) for 30 min, the rate of infusion being based upon the weight of the animal from which the aorta had been removed. In four experiments the responses to vasopressin were reduced by 65–80% with a mean of 74%.

To determine if the β-adrenoceptors were involved in the phenomenon, the experiment was repeated with propranolol (3.3 μM) in the Krebs solution bathing the tissue. It was without effect on the responses to vasopressin and it did not prevent the desensitization produced by the infusion of noradrenaline. When phentolamine (5–7 μg kg^{-1} min^{-1}) was infused together with the noradrenaline, the response to the latter was blocked. Thirty minutes after stopping the infusion of both drugs, but continuing to perfuse Krebs solution through the organ bath at the rate of 10 ml min^{-1}, the responses to noradrenaline were fully restored and those to vasopressin were unaffected. Thus blockade of the α-adrenoceptors prevented the desensitization.

It was established that clonidine, which stimulates presynaptic α-adrenoceptors preferentially (Starke, Montel, Gayk & Merker, 1974), was 100 times less effective than noradrenaline on post-synaptic α-adrenoceptors in this tissue. Phenylephrine, which stimulates post-synaptic α-adrenoceptors preferentially (Starke, Endo & Taube, 1975) was equipotent with noradrenaline on these receptors.

When infusions of clonidine varying from 450 ng to 2.5 μg kg^{-1} min^{-1} were employed the responses to vasopressin in 5 experiments were reduced by 43–77% with a mean of 56%. Infusions of phenylephrine (52 μg kg^{-1} min^{-1}) reduced the responses to vasopressin by 24–40% with a mean of 32% in 4 experiments.

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Effects of catecholamine antagonists on the milk-ejection reflex of the anaesthetized rat

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The 'oxytocinergic' neurones of the supraoptic and paraventricular nuclei of the lactating rat display a rapid burst of action potentials (> 40 Hz, 2–4 s) every 5–15 min during suckling (Lincoln & Wakerley, 1975). This burst of neuronal activity releases a pulse of oxytocin (~ 1 mU) from the neurohypophysis; this circulates to the mammary glands, contracts the myoepithelial cells and ejects the milk. Catecholamines may be involved in the central control of this neuroendocrine reflex for both noradrenaline and dopamine release oxytocin and vasopressin when placed in the lateral ventricles of the brain (Kuhn, 1974; Bridges, Hillhouse & Jones, 1975). This study examines the effects of antagonists of noradrenaline and dopamine upon the milk-ejection reflex of the rat, for with the exception of the ergot alkaloids which prevent milk ejection in the conscious rat (Grosvenor & Turner, 1957) no such study has been reported.

Rats, from day 7–10 of lactation and separated from their young for 16 h, were anaesthetized with urethane (1.1 g/kg, i.p.) and the teat ducts of two mammary glands were cannulated to record intramammary pressure. Three hours later, and whilst the animals were still deeply anaesthetized, 10 pups were applied to the uncannulated nipples. Each milk ejection in the subsequent 3 h period of suckling was recorded; each ejection was associated with an abrupt rise in intramammary pressure and a concomitant behavioural response from the pups. The antagonists were given i.v. after 60–90 min, i.e. after the occurrence of 5–8 milk ejections. In this control period, and after saline treatment, milk ejections were observed at regular intervals of 6.5 ± 2.3 min (s.d.).

The α-adrenergic blocking drug phentolamine (0.4 mg/kg) caused a three-fold increase in the interval to the first milk ejection following its administration. Higher doses were more effective, and at 1.6 mg/kg this milk ejection interval increased to about 120 minute. By contrast, the β-adrenergic antagonist propranolol (5 mg/kg) failed to block the reflex. Haloperidol, pimozide and metoclopramide, all considered as dopamine antagonists, also prevented milk ejection. Haloperidol and pimozide were equi-effective, causing a three-fold increase in the latency at 1.5 mg/kg, whereas 7.0 mg/kg metoclopramide was required for the same result. A six-fold increase in latency (i.e. 39 min) was obtained with 4.0 mg/kg haloperidol, 4.5 mg/kg pimozide and 12 mg/kg metoclopramide; the period of antagonism was related linearly to the dose. Partial responses, associated with the release of small pulses of hormone, were rarely observed. Further, the milk-ejection intervals which followed the initial delay were within the control range. A direct action of the drugs on the neurohypophysis or mammary glands was unlikely, since the milk-ejection responses to exogenous oxytocin and electrical stimulation of the neurohypophysis were not decreased. Hexamethonium (2 mg/kg) did not inhibit milk ejection, though it caused a similar reduction in blood pressure to that observed with the antagonists.

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The effects of prostaglandins E_1 and E_2 on heart rate responses to cervical sympathetic nerve stimulation and ganglion stimulant drugs in the anaesthetized mouse

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Prostaglandins E_1 and E_2 inhibit the bradycardia caused by vagal stimulation in anaesthetized mice (Feniuk & Large, 1975). Their effect has now been studied on the tachycardia produced by either cervical sympathetic nerve stimulation (Large, 1975) or administration of drugs.

Anaesthetized mice were prepared as described by Feniuk & Large (1975). Following section of the left cervical sympathetic and both vagi, the intact right cervical sympathetic nerve was stimulated through bipolar electrodes (rectangular pulses; 0.5 ms duration; supramaximum voltage). Prostaglandins were injected i.v. when the tachycardia to a given frequency of stimulation had levelled and % changes were measured. In assessing the reduction of drug-induced tachycardia, prostaglandins were given 30–60 s prior to the third successive injection of the stimulant drug.

Initial mean arterial pressure was 52 ± 3 mm Hg and heart rate was 430 ± 9 bts/minute. Frequency-dependent tachycardia occurred with nerve stimulation, the maximum usually at 10 Hz (ΔHR = 208 ± 11 bts/min). Prostaglandins E_1 and E_2 caused dose-dependent inhibition of the tachycardia which seemed more pronounced at the lower frequencies of stimulation. There was also marked inhibition by the prostaglandins of the tachycardia produced by the muscarinic stimulant McN-A-343 (4-(*m*-chlorophenylcarbamoyloxy)-2-butynyltri methyl ammonium chloride), but virtually no modi fication of the responses elicited by either DMPP (1,1 dimethyl-4-phenyl piperazinium) or by noradrenaline (Table 1). Similar results were obtained with the prostaglandins when nerve stimulation or DMPP injection was made in the presence of atropine (0.5 mg/kg) or when McN-A-343 injection was made after hexamethonium (2.5 mg/kg).

Although the results demonstrate that the prostaglandins can modify sympathetic transmission to the heart *in vivo*, their site of action is still unknown.

Table 1 The effect of i.v. prostaglandins $E_1(PGE_1)$ and $E_2(PGE_2)$ on the tachycardia induced by either sympathetic nerve stimulation or various drugs in the anaesthetized mouse

	Control response mean hr beats/min	*% Control Responses*					
			Dose PGE_1			*Dose PGE_2*	
		10 µg/kg	*20 µg/kg*	*40 µg/kg*	*10 µg/kg*	*20 µg/kg*	*40 µg/kg*
0.5 Hz	92 ± 7(30)	83 ± 2(4)	53 ± 9(5)	25 ± 7(3)	85 ± 5(7)	58 ± 10(7)	42 ± 5(4)
1 Hz	121 ± 5(29)	84 ± 3(4)	52 ± 6(5)	43 ± 4(3)	88 ± 2(6)	62 ± 2(5)	55 ± 8(6)
2 Hz	139 ± 7(29)	88 ± 2(5)	67 ± 5(6)	55 ± 5(4)	84 ± 8(5)	68 ± 7(5)	58 ± 14(4)
5 Hz	183 ± 7(25)	88 ± 5(6)	82 ± 7(4)	79 ± 10(4)	98 ± 1(4)	95 ± 2(4)	90 ± 2(5)
NA (1–2 µg/kg)	71 ± 5(19)	115 ± 8(4)	112 ± 9(3)	—	106 ± 9(4)	97 ± 4(6)	95 (2)
DMPP (100–300 µg/kg)	97 ± 10(9)	—	—	90 ± 11(3)	—	—	102 ± 8(6)
McN-A-343 (60–200 µg/kg)	93 ± 5(10)	—	—	11 ± 6(4)	—	—	22 ± 7(6)

Figures in parentheses indicate number of observations. All values are means ± s e. mean. All doses of the stimulant drugs produced submaximal tachycardia.

Antagonism of noradrenaline's direct action on the effector organ is unlikely. Alternatively an effect on postganglionic neurones is possible because the prostaglandins can inhibit both responses to McN-A-343, which are mediated via muscarinic receptors on this structure (present paper), and noradrenaline release from electrically stimulated postganglionic nerves (e.g. Hedqvist & Wennmalm, 1971). However, an additional inhibition by prostaglandins of preganglionic acetylcholine release should be considered, since the prostaglandins failed to reduce the tachycardia caused by DMPP's stimulation of nicotinic receptors in the ganglia. This lack of an effect by the prostaglandins might be merely a function of dose or because DMPP-induced tachycardia relies heavily on amines released from the adrenals. Experiments are being conducted to investigate these possibilities.

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Interaction between the release of SRS-A and of prostaglandins

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Walker (1973) found in human chopped lung that treatment with indomethacin potentiated the release of SRS-A and suggested that prostaglandins inhibit its release. We investigated the effects of three non-steroid anti-inflammatory drugs on the release of SRS-A and histamine from sensitized guinea-pig lungs during challenge.

Lungs were removed from guinea-pigs previously sensitized to ovalbumen and rapidly perfused via the pulmonary artery with oxygenated Tyrode (37°C) at 5 ml/minute. Lungs were challenged by intra-arterial (i.a.) injection of ovalbumen (Sigma, grade III). The effluent was collected on ice for 10 minutes. The SRS-A content was estimated by immediately assaying aliquots of effluent on a strip of smooth muscle from guinea-pig ileum (blocked with mepyramine and hyoscine) against a laboratory standard preparation of

SRS-A. Results were expressed in arbitrary units. Histamine was assayed either biologically or fluorimetrically. Prostaglandin content was estimated by radioimmunoassay. Prostaglandin synthetase inhibitors were infused intra-arterially for 15 min before and during challenge.

Indomethacin (0.5–10 μg/ml) increased the amount of SRS-A released by up to 3.4 times (25 experiments). Treatment with indomethacin (1 μg/ml) produced the maximum increase in SRS-A (from 153 ± 26 to 525 ± 69 units/lung) and also reduced the output of prostaglandins. Histamine levels were also increased. Sodium aspirin (1–10 μg/ml) similarly potentiated release of SRS-A; the maximum increase produced by aspirin (5 μg/ml) was from 138 ± 26 to 465 ± 62 units/lung. This dose of aspirin also increased the amount of histamine released from 4.43 ± 0.6 to 19.5 ± 2.9 μg/lung as estimated by bioassay and fluorimetric assay (15 experiments).

Sodium meclofenamate 0.1–1.0 μg/ml increased SRS-A output by up to 2.4 times (maximum increase at 0.5 μg/ml i.a.; 16 experiments) and there was an increased amount of histamine released.

A bell-shaped dose-response curve was seen with all three drugs. The decreasing effects with increasing doses of anti-inflammatory drugs may be due to inhibition of enzymes such as phosphodiesterase.

Piper & Vane (1969) showed that a sample of SRS-A released rabbit aorta contracting substance (RCS; now thought to be a mixture of prostaglandin endoperoxides and thromboxane A_2 (Hamberg, Svensson & Samuelsson, 1975)) from unsensitized guinea-pig lungs. In the present experiments, injection of 0.5 units (laboratory standard) of two newly prepared samples of SRS-A i.a. into lung from unsensitized guinea-pigs released RCS and prostaglandins into the effluent (6 experiments).

These results suggest that SRS-A released in anaphylaxis may in turn release RCS and prostaglandins. They also strengthen the hypothesis that the prostaglandins then exert a negative feedback on further release of SRS-A. It is therefore not difficult to understand why inhibition of prostaglandin release by non-steroid anti-inflammatory drugs potentiates the release of SRS-A.

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Some properties of rabbit aorta contracting substance-releasing factor (RCS-RF)

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Rabbit aorta contracting substance-releasing factor (RCS-RF) was the name given by Piper & Vane (1969) to an unidentified factor distinct from slow reacting substance of anaphylaxis (SRS-A) found in the perfusate of immunologically shocked lungs from sensitized guinea-pig. RCS-RF injected into the pulmonary artery of perfused lungs from unsensitized guinea-pigs induced release of RCS, now thought to be a mixture of prostaglandin endoperoxides and their derivative, thromboxane A_2. We have now partially purified RCS-RF and describe some of its physiochemical and pharmacological properties.

Lungs from guinea-pigs sensitized to ovalbumin (Piper & Vane, 1969) were perfused with Krebs solution at 10 ml/min and shocked with ovalbumin (10 mg) injected into the pulmonary artery. Perfusate collected over the next 5 min was centrifuged at 5000 *g*, filtered, lyophilized and redissolved in distilled water to give about one tenth of the original volume. A batch of perfusate (about 50 ml) from a single lung contained 1000–2000 units of RCS-RF activity (defining 1 unit as that amount which gives the same release of RCS from perfused lung as 1 μg of arachidonic acid.)

The active principle was removed from the crude perfusate by adsorption onto Amberlite XAD-2 and was recovered from the resin in about 75% yield by elution, with ethanol-water (80:20, v/v), giving a preparation almost completely free of salts, proteins and histamine. The ethanol-water extract was dried *in vacuo* and washed three times with dry diethyl-ether.

The residue, when dissolved in distilled water, was stable for at least six weeks at −10°C.

The preparation was chromatographically free of fatty acids and prostaglandins but traces of phospholipid material remained. There was no prostaglandin-like activity when tested on the rat fundus strip, rat colon and chick rectum (Ferreira & Vane, 1967). High doses (5.0 U) contracted the guinea-pig ileum and rat stomach strip. However, RCS-RF was distinguished from SRS-A by its potent RCS releasing properties. Furthermore, RCS-RF activity was not destroyed by incubation with the enzyme arylsulphatase which selectively inactivates SRS-A (Orange, Murphy & Austen, 1974). Indeed, RCS-RF activity was often increased by incubation with arylsulphatase.

RCS-RF is insoluble in ether, chloroform, ethyl acetate, acetone and ethanol but is more soluble in methanol. It is very polar as judged by its behaviour in several lipid chromatography systems. It is destroyed by acid or alkali (2 h at pH 2 or pH 12) but not by mild base treatment (0.1 N NaOH for 30 minutes). It loses < 10% activity after boiling for 2 min but is substantially (> 75%) degraded after 10 min at 100°C. Passage through a dialysis membrane suggests that it is a small molecule (< 5000 m.w.).

The release of RCS-RF was not prevented by aspirin (200 μg/ml), indomethacin (2 μg/ml), dexamethasone (2 μg/ml), di-sodium cromoglycate (20 μg/ml), colchicine (5 μg/ml), diethyl carbamazine (1 mg/ml) or mepacrine (20 μg/ml) but the release of RCS by the factor was blocked by these substances (except di-sodium cromoglycate and colchicine) in the same doses. All but dexamethasone also blocked the conversion in perfused lungs of arachidonic acid to RCS, implying direct block of the cyclo oxygenase. Dexamethasone, however, blocked the release of RCS by RCS-RF without affecting release by arachidonic acid.

RCS-RF does not release RCS or prostaglandin from guinea-pig perfused kidneys (which only convert arachidonic acid to PGE_2). RCS-RF has no inflammatory action in the rat paw (8 u/rat) oedema test but does cause hyperalgesia. This is partially (80%) blocked by indomethacin (10 mg/kg). It does not aggregate human platelets (10 u/ml).

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The effects of prostaglandin endoperoxides and thromboxane A_2 on strips of rabbit coeliac artery and certain other smooth muscle preparations

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Rabbit aorta contracting substance (RCS) contracts all vascular tissue tested and is generated by lung and other tissues after several stimuli, including immunological shock and bradykinin or arachidonic acid injection (Piper & Vane, 1969; Vargaftig & Dao Hai, 1971; Palmer, Piper & Vane, 1973). RCS is unstable and is probably a mixture comprising mainly thromboxane A_2 (TxA_2; half-life 30 s) with some prostaglandin endoperoxides (PGG_2 and PGH_2; half lives approximately 5 min) (Hamberg, Svensson & Samuelsson, 1975). We have compared the effects on various smooth muscle preparations of PGG_2, PGH_2 and TxA_2 with the stable prostaglandins.

Tissues were superfused in cascade at 10 ml/min with Krebs solution at 37°C containing a mixture of antagonists (Gilmore, Vane & Wyllie, 1968) plus indomethacin (1 μg/ml). As well as rat stomach strip, rat colon and chick rectum, strips of rabbit vascular tissue (cut spirally) were tested.

Prostaglandin endoperoxides were prepared by incubating microsomes of ram seminal vesicles with arachidonic acid at 20°C without co-factors. Endoperoxides were purified by low temperature column chromatography (Ubatuba, Moncada & Vane, unpublished). Thromboxane A_2 was prepared by incubation of PGG_2 or PGH_2 with horse platelet microsomes at 0°C (Needleman, Moncada, Bunting, Hamberg, Samuelsson & Vane, unpublished). TxA_2 was then rapidly ($\simeq$ 1 min) extracted by shaking (20 s) with two parts dry ether (0°C) at neutral pH, dried under nitrogen and redissolved in buffer immediately before testing.

The rat stomach strip was contracted by prostaglandin E_2 (PGE_2) being more potent than PGG_2 and PGH_2 (2-3 x) and TxA_2 (10 x). On rat colon, TxA_2 was inactive (up to 50 ng); $PGF_{2\alpha}$ was 12–15 times more potent than the endoperoxides. On chick rectum PGE_2 was more potent than the endoperoxides (2-3 x) and TxA_2 (4 x). On rabbit aorta, TxA_2 was 30–50 times more potent than the endoperoxides; PGE_2 and prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) were inactive (up to 200 ng). Some of these results confirm ratios previously described (Nugteren & Hazelhof, 1973; Willis, Vane, Kuhn, Scott & Petrin, 1974).

The most interesting effects were on coeliac and mesenteric artery. PGE_2 (1–20 ng) relaxed these preparations, as did PGG_2 and PGH_2 at about one fifth of the potency. In some preparations the PGG_2 or PGH_2 induced relaxation preceded by a short-lasting contraction. Thromboxane A_2 contracted both preparations. Coeliac artery recovered from relaxation in 5 min whereas mesenteric artery took considerably longer.

We conclude that (a) the RCS described by Piper & Vane (1969) was predominantly TxA_2 since it contracted strips of rabbit coeliac artery (Palmer *et al.*, 1973) (b) PGG_2, PGH_2 and TxA_2 are much more potent on vascular tissue than on smooth muscle from gastrointestinal tract and (c) the coeliac artery preparation distinguishes between the endoperoxides and TxA_2. It will be interesting to compare these activities with vascular effects of the same substances *in vivo*.

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Bioassay and thin-layer chromatography of prostaglandins and their pulmonary metabolites

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Piper & Vane (1969) reported that prostaglandins are released from guinea-pig lungs during anaphylaxis. Mathé & Levine (1973) and Leibig, Bernauer & Peskar (1974) have shown that prostaglandin metabolites are also released. We have therefore investigated the effects of the pulmonary metabolites of the prostaglandins on tissues routinely used to assay parent prostaglandins. Earlier results indicate that high doses of the pulmonary metabolites of prostaglandin E_2 (PGE_2) are indistinguishable from lower doses of PGE_2 on the tissues used (Crutchley & Piper, 1975). The present studies were carried out on the pulmonary metabolites of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$).

Prostaglandins and metabolites were assayed on the rat stomach strip, chick rectum, rat colon and oestrogen-primed rat uterus as described (Crutchley & Piper, 1975). Thin-layer chromatography was carried out using the AI, AII and AIII systems (Green & Samuelsson, 1964; Änggard & Samuelsson, 1964).

Results of bioassay on rat stomach strip, chick rectum and rat colon indicated that 13,14-dihydro-$PGF_{2\alpha}$ was the most potent metabolite, having approximately 0.3 times the activity of $PGF_{2\alpha}$. 13,14-dihydro-15-keto-$PGF_{2\alpha}$ and 15-keto-$PGF_{2\alpha}$ had approximately 0.01 times the activity of the parent prostaglandin. However, the order of potency of metabolites was the same on all three assay tissues, making distinction on this basis impossible (Figure 1).

In the AII system, 13,14-dihydro-PGE_2 (R_f 0.80) was almost indistinguishable from PGE_1 (R_f 0.82) and 13,14-dihydro-PGF_2 (R_f 0.50) was similarly indistinguishable from PGE_2 (R_f 0.50). Thin-layer chromatography in the AI and AIII systems also failed to separate these prostaglandins. When tested on rat stomach strip, rat colon and chick rectum

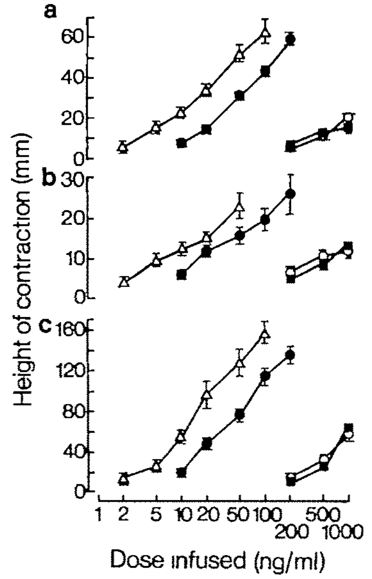

Figure 1 Comparative bioassay of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) (△) and its pulmonary metabolites 13,14-dihydro-PGF (●), 15-keto-$PGF_{2\alpha}$ (O) and 13,14-dihydro-15-keto-$PGF_{2\alpha}$ (■) on (a) rat stomach strip, (b) chick rectum and (c) rat colon Prostaglandin $F_{2\alpha}$ or metabolites were given as random 2 min infusions into the Krebs solution superfusing the assay tissues. The height of contraction of the assay tissues was plotted against the log dose of agonist Each point is the mean of 9–11 experiments. Vertical bars show s.e. mean

PGE_1 and dihydro-PGE_2 did not give parallel bioassay. Similar results were obtained with PGE_2 and 13,14-dihydro-$PGF_{2\alpha}$. However, the differences obtained would not be sufficient to allow distinction between these PGs and metabolites in a biological fluid. 13,14-dihydro-$PGF_{2\alpha}$ was approximately 1.7 times as active as $PGF_{2\alpha}$ and approximately 3.0 times as active as PGE_2 on the oestrous rat uterus.

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Prostaglandins and tone in isolated strips of mammalian bladder

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It has been demonstrated in a group of patients with paralysed atonic bladders that the intravesical instillation of prostaglandin E_2 (PGE_2) restores a normal pattern of micturition (Bultitude, 1973). The local production of prostaglandins has been implicated in the maintenance of tone and spontaneous activity of smooth muscle of the intestine (Ferreira, Herman & Vane, 1972), uterus (Vane & Williams, 1973) and trachea (Farmer, Farrar & Wilson, 1974). The object of the present investigation was to determine whether prostaglandins have a similar function in the bladder.

Strips of either detrusor or trigone muscle from the bladder of rabbit, rat, cat, dog, sheep, guinea-pig or human were suspended in Tyrode's solution at 37°C, bubbled with O_2 (95%):CO_2 (5%) mixture. A tension of 1 g was applied. Contractions were measured isometrically and displayed on a Servoscribe 1 s potentiometric recorder.

Prostaglandin E_2 (0.2–6.0 µg/ml) and prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) (0.2–6.0 µg/ml) caused contractions of the strips, but the log dose-response curve obtained was much less steep than that of carbachol. The tone and spontaneous activity of the strips was reduced by indomethacin (0.5–2 µg/ml), meclofenamic acid

(0.5–1 μg/ml) and flufenamic acid (5–10 μg/ml) in all species except the guinea-pig. The addition of PGE_2 and $PGF_{2\alpha}$ (10–20 ng/ml) reversed the effects of these substances causing a return of tone and spontaneous activity. Bioassay of the bath fluid of the rabbit detrusor strips and thin layer chromatography done in association with N.G. Bowery, indicated, by the R_f value of the biological activity, the presence of PG-like activity of the E-series. In the presence of indomethacin no activity was detectable.

The addition of physostigmine (1 μg/ml) to the rabbit isolated detrusor strip produced an increase in tone and spontaneous activity which was prevented by the prior addition of indomethacin. Prostaglandin E_2 reversed this effect of indomethacin. Hyoscine (300 ng/ml), which did not affect the resting tone or spontaneous activity, abolished the response to physostigmine. These results suggest that there may be a link between acetylcholine output and PG production in the bladder preparation. Preliminary experiments with hemicholinium-3 support this possibility.

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Effects of metyrapone on rat uterine prostaglandin release and on spontaneous smooth muscle activity *in vitro*

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Parnham & Sneddon (1975) have shown that metyrapone, an inhibitor of corticosteroid biosynthesis (Chart & Sheppard, 1959), when administered *in vivo* inhibits the subsequent release of prostaglandin F (PGF) from the isolated pregnant rat uterus. It also inhibits the conversion of ^{14}C-arachidonic acid to prostaglandin E_2 (PGE_2) by crude homogenates of pregnant rat uteri at the same time stimulating the synthesis of labelled prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$). In an attempt to clarify the action of metyrapone its direct effect on the isolated pregnant rat uterus has been investigated.

Uteri were removed from pregnant rats on the morning of day twenty-two. Individual horns were mounted in 75 ml organ baths and bath fluid collected every 15 min for 1 h, as described previously (Vane & Williams, 1973), while uterine activity was recorded isotonically. Metyrapone (to give 0.5, 1, 2 or 4 mM) was injected into one bath at the start of the experiment and the corresponding volume of vehicle (0.33M (+)-tartaric acid; 0.05–0.4 ml) was injected into a second organ bath containing the contralateral uterine horn. Both solutions were left in contact with the tissue for 15 min, and then washed out. Prostaglandins were extracted from bath fluid as described by Vane & Williams (1973), subjected to column chromatography to separate PGs E and F (Parnham & Sneddon, 1975) and the relevant fractions were resuspended in 2 ml saline for bioassay either on the isolated rat colon against authentic $PGF_{2\alpha}$ or on the isolated rat stomach strip against authentic PGE_2. At low doses of metyrapone the release of both PGE and PGF was stimulated when compared with controls (291 ± 67% and 182 ± 25% at 0.5 mM, respectively; 4 exp/dose); but at higher doses PGF release was inhibited (65 ± 8% at 4 mM), whereas PGE release was unaffected.

Metyrapone rapidly inhibited spontaneous uterine contractions which reappeared within 5–10 min following washout. This inhibition was dose-dependent and involved reduction of tone at high doses. Similar dose-dependent inhibition of spontaneous contractions by metyrapone, was observed on the isolated rabbit ileum. This did not involve a reduction in tone at the doses used. Propranolol (1 μg/ml) antagonized the inhibitory effect of isoprenaline on this preparation, but had no effect on the response to metyrapone. The dose-response curve to metyrapone on the rabbit ileum was similar to that for papaverine, which was approximately 10 times more potent than metyrapone on a molar basis.

In two experiments on the isolated uterus of the non-pregnant rat (primed with 200 μg oestradiol benzoate i.m. 18 h previously) metyrapone antagonized contractile responses to acetylcholine and to PGE$_2$ but responses to PGF$_{2\alpha}$ suggested slight stimulation.

These results suggest that metyrapone has a non-specific direct smooth muscle inhibiting action. They also support the earlier suggestion (Parnham & Sneddon, 1975) that metyrapone has a differential effect on the synthesis of PGF and PGE in the pregnant rat uterus *in vitro*; similar to that recently observed with gold salts and phenylbutazone on sheep seminal vesicles (Stone, Mather & Gibson, 1975).

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Effects of anti-inflammatory drugs on macrophage prostaglandin biosynthesis

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Chronic inflammation in diseases such as rheumatoid arthritis is typified by a persistent mononuclear cell infiltrate in which macrophages are prominent. Macrophages, derived from inflammatory exudates, generate substantial concentrations of prostaglandin activity when cultured *in vitro* (Bray, Gordon & Morley, 1974). We have, therefore, examined the effect of established anti-inflammatory drugs on macrophage prostaglandin biosynthesis *in vitro*.

Macrophage-rich peritoneal exudate cell populations (60–80% macrophages) were collected from guinea-pigs, 2–3 days after intraperitoneal injection of 20 ml 2% starch solution. Cells (1×10^6/ml) were cultured in Eagles MEM containing antibiotics, and 10% heat-decomplemented foetal calf serum, in 5% CO$_2$ in air at 37°C for 24 hours. Prostaglandin E-like activity in the supernatant was measured by radioimmunoassay utilizing sheep anti-PGE$_2$/BSA antiserum whose cross-reactivity was PGE$_2$ (100%), PGE$_1$ (55%), PGF$_{2\alpha}$ (1.5%), 15 keto-PGE$_2$ (1.2%), PGA$_2$ (0.6%) and PGB$_2$ (0.2%).

Macrophage PG production was 12.0 ± 2.76 ng PGE$_2$ equivalent/10^6 cells per 24 h (range 2.2–43.2). In agreement with previous studies (Vane, 1971; Flower, 1974), non-steroidal anti-inflammatory drugs (NSAIDs) caused dose-related inhibition of prostaglandin biosynthesis with rank order of potency (Table 1) approximating anti-inflammatory activity.

Table 1 Inhibition of macrophage prostaglandin synthesis

Drug	*ID$_{50}$ (ng/ml)*	*Relative Potency**
Arylalkanoic Acids:		
Indomethacin	1.15(8)†	100
Ketoprofen	13.6 (2)	2.06
Naproxen	225 (2)	0 12
Pyrazolidinediones:		
Phenylbutazone	1450 (2)	0 15
Feprazone	400 (2)	0.55
Salicylates:		
Acetyl Salicylic Acid	280 (2)	0.35
Sodium Salicylate	5300 (2)	0.018
Glucocorticosteroids:		
Hydrocortisone	108 (2)	1.01
Prednisolone	26.7 (2)	4.09
Dexamethasone	4.35(2)	25.13

* Relative potency was obtained by comparison of the ID$_{50}$ with the ID$_{50}$ for indomethacin (expressed as 100) determined in the same experiment.
† Number of experiments in parenthesis.

Although anti-inflammatory glucocorticosteroids fail to inhibit prostaglandin synthetase *in vitro* (Flower, 1974), three such compounds exhibited dose-related inhibition of macrophage prostaglandin production with relative potencies (Table 1) closely paralleling their anti-inflammatory activities.

The pharmacological response of macrophage prostaglandin biosynthesis to both steroids and NSAIDs mimics that of cultured human rheumatoid synovial fragments which contain abundant macrophages and lymphocytes but few polymorphs (Robinson, Smith & Levine, 1973; Kantrowitz, Robinson, McGuire & Levine, 1975); whilst both human lymphocytes (Ferraris & DeRubertis, 1974) and polymorphs (Zurier, 1975) have relatively little prostaglandin biosynthetic capacity. We propose that the macrophage is a relevant *in vitro* model of prostaglandin production in chronic inflammation.

This work was carried out in the Laboratory of Applied Physiology, Division of Immunology, The Kennedy Institute, London W6 7DW.

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Effects of indomethacin on prostaglandin levels and leucocyte migration in an inflammatory exudate *in vivo*

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Indomethacin inhibits sub-plantar and intrapleural oedema formation after the injection of carrageenan in the rat and reduces the migration of leucocytes in the pleurisy model (Blackham & Owen, 1975). The drug is a potent inhibitor of prostaglandin synthetase activity *in vitro* and decreases the formation of prostaglandins in developing inflammatory exudates in the whole animal (Ferreira & Vane, 1974). It is possible to construct a unitary hypothesis for all these effects. A primary action of indomethacin on prostaglandin synthetase activity would cause a blockade of prostaglandin formation thus reducing both the increased vascular permeability and cellular infiltration. The latter aspect is involved since prostaglandin E_1 (PGE_1), released from phagocytosing leucocytes has been reported to be chemotactic (Higgs, McCall & Youlten, 1975) and would be expected to sustain the developing inflammation by ensuring a continued entry of more leucocytes into the exudate.

The results of recent work (Ford-Hutchinson, Smith & Walker, 1976) have questioned the chemotactic ability of endogenously produced prostaglandins and we have therefore investigated the possibility that the effects of indomethacin on prostaglandin formation and cellular migration are produced by independent mechanisms. The content of prostaglandins, assayed biologically and expressed as prostaglandin E_2 (PGE_2), and the number of leucocytes were measured in the exudates formed after 9 h in inert plastic sponges implanted subdermally in groups of rats (Ford-Hutchinson, Smith, Elliott, Bolam, Walker, Lobo, Badcock, Colledge & Billimoria, 1975). Each group received either saline (controls), plasma fraction (Walker, Smith, Ford-Hutchinson & Billimoria, 1975), indomethacin or 5, 8, 11, 14-eicosatetraynoic acid (TYA), a specific inhibitor of prostaglandin biosynthesis from fatty acid precursors (Shaw, Jessup & Ramwell, 1972).

The results (Table 1) show that the plasma fraction significantly inhibited the migration of polymorphonuclear and mononuclear leucocytes into the exudate but did not affect the formation of prostaglandins whereas TYA produced the reverse response. Thus the two phenomena are not interdependent. Indomethacin inhibited both the prostaglandin content and the cellular migration, the former was almost completely suppressed at all the doses studied but the latter was inhibited in a dose-response manner. It is concluded that the inhibitory effects of

Table 1 Effect of plasma fraction, indomethacin and TYA on PGE$_2$ content and total leucocyte counts into the exudate of inert 9 h sponges implanted subdermally in the rat

	PGE$_2$ (ng.ml^{-1} exudate)	*% Inhibition*	*Total leucocytes (× 10^4 ml^{-1} exudate)*	*% Inhibition*
Control (15)	13.2±2.4	—	1005± 93	—
Plasma fraction (5) 1 ml i.v.	12 9±1.6	2	380± 36	62**
Indomethacin (5) 1 mg kg^{-1} p.o	1.2±0.3	91**	827±142	18*
Indomethacin (5) 3 mg kg^{-1} p.o.	1.0±0.8	95**	484± 90	52**
Indomethacin (5) 6 mg kg^{-1} p.o.	1.1±0.3	92**	220± 61	78**
TYA (5) 150 mg kg^{-1} i.p.	6.5±2.0	51**	905±138	10
TYA (5) 500 mg kg^{-1} i.p.	2.6±1.1	80**	985±130	2

Results are expressed as means±s.d. with the number of animals in each group in parentheses. Levels of significance refer to the differences from the results of the control group

* $P<0.05$ ** $P<0.005$

indomethacin on prostaglandin synthetase activity and on leucocyte migration in the sponge model are independent actions of the drug. A component of the experimental anti-inflammatory activity is therefore concerned with an aspect of inflammation not involving a blockade of prostaglandin biosynthesis.

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DEMONSTRATIONS

Enhanced effect of isoprenaline after chronic administration in microanaphylactic shock of guinea-pigs

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Microanaphylactic shock can be produced in guinea-pigs, sensitized to egg albumen, by inhalation of antigen aerosol (Herxheimer, 1952). We have investigated the protective effect of acute and chronic administration of isoprenaline on the microanaphylactic shock and on the response to a mediator of anaphylaxis, histamine, given by aerosol.

Male guinea-pigs (Dunkin-Hartley, 200 g) were sensitized to egg albumen. They were then exposed individually in a perspex chamber (20 × 10 × 12 cm) to an aerosol of egg albumin (1 g/100 ml) produced by a Wright's nebulizer (air pressure 69 kPa). Preconvulsion times were measured following a procedure similar to that developed by Herxheimer (1952). The animals were exposed to the antigen at weekly intervals to avoid desensitization (Hicks & Okpako, 1968). Histamine shocks were given using an aerosol of the drug (5–10 mg/ml). Isoprenaline was given by aerosol for 2 min prior to antigen or histamine challenge–acute dosing. Chronic dosage meant a 2 min exposure three times daily for 1–3 weeks.

Acute dosing with isoprenaline protected guinea-pigs against microanaphylactic and histamine shock by increasing the preconvulsion time. The effect of isoprenaline lasted up to 15 minutes. Chronic dosing with isoprenaline progressively and reversibly increased the degree of protection obtained each week against microanaphylactic shock without a similar effect on histamine shock. The duration of action of isoprenaline was unaffected. Table 1 summarises the results of one such experiment on microanaphylactic shock.

β-Adrenoceptor agonists act not only as bronchodilators but also reduce the release of mediators of anaphylaxis (Assem & Schild, 1971). Perhaps the latter mechanism becomes more effective with chronic administration of isoprenaline.

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Table 1 Preconvulsion times (mean ± s e mean) of guinea-pigs caused by egg albumen before (control) and after inhalation of isoprenaline given by aerosol

Isoprenaline concentration in aerosol (mg/ml)	*Isoprenaline concentration in chamber (µg/l)*	*Control Preconvulsion Time (s)*	*Preconvulsion times after Isoprenaline*			
			Acute dosage	*Chronic dosage*		
				1 week	*2 weeks*	*3weeks*
0.33	6	50 ± 2.9 (6)	85 ± 5.5	112 ± 8.5	178 ± 4.3	213 ± 11.0
1	18	49 ± 4.1 (6)	140 ± 7.9	184 ± 8.1	223 ± 9.2	268 ± 19.0
10	180	55 ± 6.4 (4)	210 ± 14 8	280 ± 14.1	280 ± 12.1	—

Figures in brackets are the number of animals. The progressive increase in preconvulsion times after chronic dosage was significant ($P < 0.05$) as shown by the Friedman two-day analysis of variance by ranks (Siegel, 1956)

Models of agonist–antagonist interaction

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Competitive agonist-antagonist interactions are studied using the Schild equation (Arunlakshana & Schild, 1959). Recently, this has been modified to include the so-called 'co-operative' models of drug-receptor interaction, (Colquhoun, 1973). Geometry can be used to display these relationships and give pictures in three dimensions which yield more information that their equivalent equations. For example, the Schild equation is seen to be that of a hyperbolic paraboloid. Symmetries can then easily be discovered which reveal new designs for experiments. These designs make it possible to cover the range of available data in ways which are best, both in terms of unbiassed exploration and of experimental economy.

The demonstration consists of physical models and drawings on isometric graph networks (Figure 1).

Usually competitive antagonism is evidenced by parallel shift of a dose-response curve or a linear plot when the dose ratio of the Schild equation is plotted against the antagonist dose. This can be established with equal rigour, greater economy and better statistical freedom by using the vector equations

$$\cos\gamma = \frac{y\cdot x}{|y|\,|x|} = \frac{z\cdot x}{|z|\,|x|}$$

$|y|=|z|$, and the symmetries shown in Figure 1 about the central parabola of the system,

$$X(t)=(t-1,\ t^2,\ t),$$

where t is a parameter.

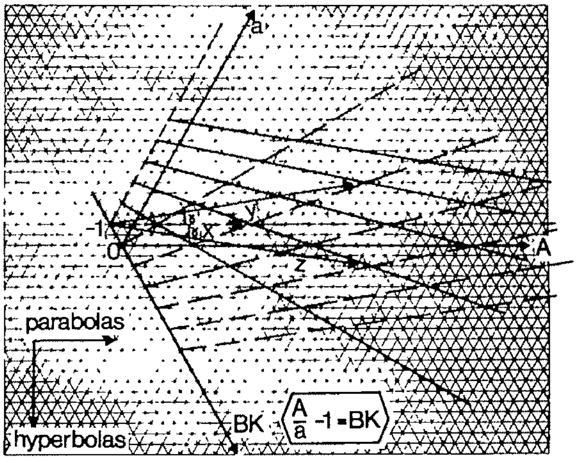

Figure 1 The Schild equation plotted on isometric paper. A is the agonist dose in presence of antagonist at dose B. The equieffective dose of agonist alone is a; K is the antagonist affinity constant. X, Y, Z are vectors, γ is the angle between them.

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An apparatus for automatically recording diuresis in laboratory animals

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An apparatus has been developed for the continuous recording on photographic film of diuresis in laboratory animals. Ten mice are housed in each of 16 metabolic cages, arranged in a circle mounted on a table. Urine from each cage is collected in a measuring cylinder. A 35 mm camera (Shackman Auto Camera, Mark 3) and an electronic flash unit (National PE-243) are mounted on a motorized turntable revolving once per hour. The volume of urine contained in each cylinder is photographed at predetermined intervals of time. The measuring cylinders containing the urine samples are automatically removed at the end of the experiment enabling subsequent estimation of electrolytes. After development of the film, the urine volumes are read from the negatives, using a projector.

The apparatus has the advantages of providing a permanent record of the data on film and does not require constant supervision. In addition, experiments can be performed during periods of the day or night when stressful stimuli are at a minimum. The apparatus can be readily adapted for use with different laboratory animals, and the effects of diurnal variation in urine excretion on the actions of drugs can be studied.

A simple and inexpensive device for the *in vivo* detection and counting of ventricular extrasystoles

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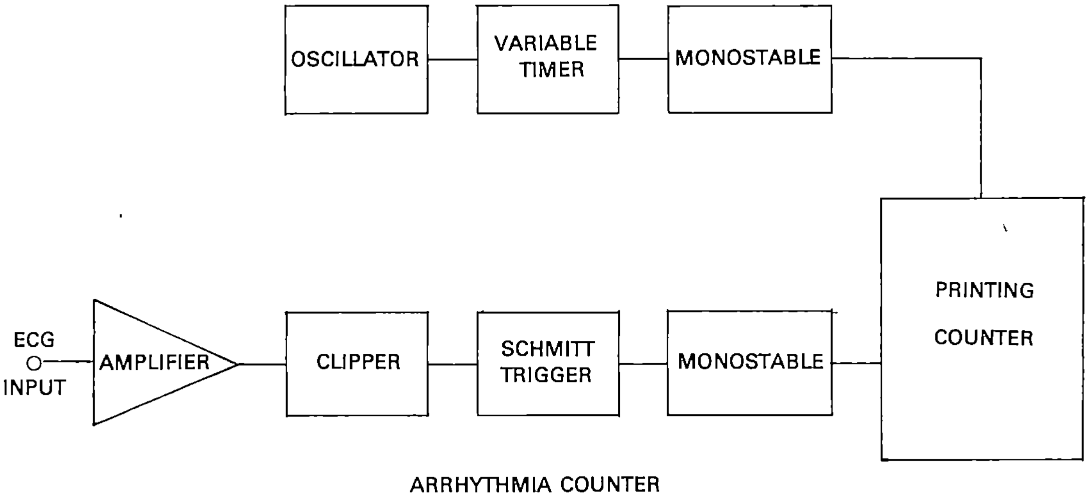
A tedious aspect of experiments aimed either at producing cardiac arrhythmias or assessing potential antiarrhythmic drugs is the detection and counting of the arrhythmias under examination. Ventricular ectopic beats or extrasystoles are recognized typically by large negative deflections of the lead II or chest leads of the electrocardiogram. We have utilized this effect and report here the development of an inexpensive and simple device to detect and automatically count ventricular extrasystoles. A block diagram of the major interactive components is shown in Figure 1.

After amplification the ECG is switched through one of two clipper diodes admitting either positive only or negative only signals via a Schmitt trigger and



ARRHYTHMIA COUNTER

Figure 1

monostable to a printing counter. The printer is controlled by a variable timer allowing the printing of numbers of arrhythmias in any desired time interval of between 6 s and 100 minutes.

With the Harris (1950) two-stage coronary artery ligation model of ventricular arrhythmias in the dog, we normally use ECG lead II or CR and allow the counter to be triggered in the negative mode. If, for any reason, the ECG is itself negative, then a switch permits the user to choose positive triggering of the counter. On occasions, the baseline of the ECG may wander because of respiratory or other skeletal muscle movements by the animal and to prevent negative excursions of the baseline giving rise to artefactual counts a d.c. level clamp may be included prior to the amplifier.

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Substituted benzamides as dopamine antagonists

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A number of substituted benzamides have recently been developed for their anti-emetic and anti-psychotic properties. Previous studies with one such compound, metoclopramide (*N*-[diethylaminoethyl]-2-methoxy-4-amino-5-chlorobenzamide) have indicated that it has biochemical and behavioural properties associated with the blockade of cerebral dopamine receptors (Dolphin, Jenner, Marsden, Pycock & Tarsy, 1975; Peringer, Jenner & Marsden, 1975; Donaldson, Jenner, Marsden, Peringer & Miller, 1976). These studies have now been extended to include sulpiride (*N*-[1′ethyl-2′-pyrrolidinyl methyl]-2-methoxy-sulphamoyl benzamide), tigan (*N*-[(2′dimethylaminoethoxy) benzyl]-3,4,5-trimethoxyl benzamide) and clebopride (*N*-[*N*′-benzylpiperidin-4′-yl]-4-amino-5-chloro-2-methoxy-benzamide) and its debenzylated metabolite.

All of these compounds were found to: inhibit the apomorphine (2 mg/kg i.p.) reversal of reserpine (10 mg/kg i.p. 18 h before apomorphine) induced akinesia in mice, inhibit the apomorphine (0.5 mg/kg s.c.) induced circling in mice with unilateral 6-hydroxydopamine induced striatal lesions, induce some degree of catalepsy, induce ipsilateral circling in apomorphine (0.5 mg/kg s.c.) treated rats following their administration via intrastriatal cannulae (25 or 100 µg in 3 µl 0.9% saline).

Thus these compounds all exhibit behavioural properties thought to be associated with blockade of central dopamine receptors. Biochemical studies have shown that these compounds induce a rise in the brain concentration of the dopamine metabolite homovanillic acid and, to a lesser extent, the intraneuronal metabolite dihydroxyphenyl acetic acid. These findings are also consistent with a central blocking action of the compounds on dopamine receptors (Donaldson *et al.*, 1976).

In the *in vitro* rat striatal dopamine (10^{-4} M) stimulated adenylate cyclase system, however, metoclopramide, sulpiride, tigan and the clebopride metabolite had no inhibitory action at 10^{-7}–10^{-4} M. Clebopride caused a small reduction in cyclic AMP production at 10^{-4} M.

Thus, although these substituted benzamides exert pharmacological and biochemical effects consistent with their being dopamine antagonists, they have little effect in the adenylate cyclase model of the dopamine receptor. Their mode of action therefore remains an open question.

We thank A.H. Beckett for his interest in this work.

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The influence of glucagon upon the responses of the hepatic arterial vasculature to vasodilator agents

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It had previously been demonstrated (Richardson & Withrington, 1975, 1976) that administration of glucagon into the hepatic arterial vascular bed of the dog not only causes hepatic arterial vasodilatation, but also reduces the vasoconstrictor effects of intra-arterial noradrenaline, angiotensin and vasopressin on this bed. The possibility that glucagon might either potentiate or antagonize the responses of this tissue to vasodilator agents was examined.

Under control conditions, in five chloralose-urethane anaesthetized dogs (12.3–17.5 kg) (Richardson & Withrington, 1975, 1976) the hepatic arterial perfusion pressure (PP) was 129.6 ± 7.4 (mean ± s.e. mean) mmHg. In the sympathetically innervated liver the hepatic arterial blood flow (HABF) was 54.9 ± 6.6 ml min^{-1} 100 g^{-1}, the livers weighing 348.0 ± 61.2 (mean ± s.d.) grams. The calculated hepatic arterial vascular resistance (HAVR) was 2.58 ± 0.46 mmHg ml^{-1} min 100 grams.

Isoprenaline sulphate (Macarthys) and histamine acid phosphate (BDH) were injected intra-arterially to the liver in graded doses and dose-dependent reductions in hepatic arterial vascular resistance were obtained. The complete dose/response curves to isoprenaline and histamine were constructed before, during and after the intra-arterial infusion of 10.0 µg/min glucagon (Lilly). This infusion of glucagon itself results in a fall in HAVR of 28.9 ± 4.4% ($n = 6$). The decreases in HAVR due to the graded doses of isoprenaline and histamine were reduced during the infusions of glucagon compared with the control responses either before or after the infusions. If, however, the vasodilator action of glucagon was taken into account and the decreases in hepatic arterial vascular resistance due to isoprenaline and histamine during glucagon calculated from the pre-glucagon infusion level, then it was evident that there was no shift in the dose-response curves to either histamine or isoprenaline, and in one experiment, to prostaglandin E_2(PGE_2).

In previous experiments, the extent and time-course of the antagonism of the effect of noradrenaline, angiotensin and vasopressin by single intra-arterial injections of glucagon were demonstrated. In the present experiments, single doses of glucagon were injected, and control doses of the vasodilators administered at various intervals before and after the injections of glucagon. A change in response to histamine, isoprenaline and PGE_2 was apparent only during the vasodilator response to glucagon; when corrections were made for the change in background tone due to glucagon, it was evident that the reductions in HAVR due to isoprenaline, histamine and PGE_2 were unaffected by the injections of glucagon.

The experiments support the suggestion that glucagon does not modify the vasodilator effects either of the physiological vasodilators histamine and PGE_2 or the synthetic vasodilator isoprenaline on the hepatic arterial vascular bed of the dog, but emphasize the difficulties inherent in assessing the antagonistic actions of a substance which itself has agonist potency.

This study was generously supported by the Medical Research Council. We thank Miss Dorinda Lobenhan and Miss June Pyke for skilful technical assistance.

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The effect of drugs on various parameters of mouse behaviour in a modified head-dipping test

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The head-dipping test developed by Boissier & Simon (1962, 1964) has been used to examine the behavioural effects produced by a variety of drugs, but its application as a screening method is limited by its failure to discriminate between drugs as divergent in their effects in man as amphetamine and chlordiazepoxide, both of which stimulate head-dipping in mice (Bradley, Joyce, Murphy, Nash, Porsolt, Summerfield & Twyman, 1968; Nolan & Parkes, 1973).

The apparatus described by Boissier & Simon is a horizontal board perforated with evenly-spaced holes. A 'dip' is scored when mice lower their head far enough into a hole for the eyes to disappear beneath the plane of the board. The test situation has been altered by dividing the board with low, narrow walls into square compartments (10×10 cm), each with a hole (3, 5 cm diameter) at the centre, so that additional behavioural parameters can be observed. Thus 'rearing' is scored when mice raise themselves onto the hind legs and the fore-paws rest on a partition wall, and 'crossing' is scored when the animal climbs over the wall dividing one compartment from another.

In contrast to the findings with the unmodified test by Bradley *et al.* (1968) and by Nolan & Parkes (1973), amphetamine, chlordiazepoxide, diazepam and amylobarbitone were found not to increase dipping significantly. However, rearing and crossing were stimulated in a dose-dependent manner by chlordiazepoxide and by diazepam, and to a lesser extent by amylobarbitone, while both parameters were inhibited by amphetamine and chlorpromazine, the latter drug in doses producing overt signs of sedation.

These results suggest that by choice of suitable parameters of mouse behaviour it might be possible to detect and distinguish the activities of several classes of CNS-acting drugs in this simple test.

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Prostaglandins and the release of histamine from rat peritoneal mast cells

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Prostaglandin E_1 (PGE_1) increases cyclic AMP levels in rat mast cells and inhibits the release of histamine by antigen (Kaliner & Austen, 1974). In the present study, we have further investigated the actions of prostaglandins and drugs affecting prostaglandin metabolism on histamine release following chemical or immunological challenge.

Mast cells were obtained by lavage of the rat peritoneal cavity with a modified buffer solution (12 ml, pH 7) containing bovine serum albumen (0.1% w/v). The solution was withdrawn, centrifuged, and the cell pellet re-suspended in the buffer. The incubation techniques, which allow at least 24 samples to be obtained from the mast cells of one rat, will be demonstrated. The histamine released from the mast cells was assayed fluorometrically (Shore, Burkhalter & Cohn, 1959) or on the superfused guinea-pig ileum.

Non-steroid anti-inflammatory drugs, which inhibit prostaglandin biosynthesis (Vane, 1971), caused a parallel displacement of the dose-response curve for the release of histamine by compound 48/80 (0.1–1 μg/ml). The dose causing 50% inhibition of submaximal histamine release (ID_{50}) was 3.5, 9.0 and 21.5 μg/ml for sodium meclofenamate, flufenamic acid and indomethacin, respectively. These drugs also inhibited histamine liberation induced by antigen (either horse serum or egg albumen) from sensitized mast cells, or that induced by adenosine triphosphate or crude phospholipase-A. Although these aspirin-like drugs had no consistent effect on non-specific histamine liberation with the surface-active agents Triton X-100 (0.01%) or *n*-decylamine (25 μg/ml), the release of histamine following incubation of mast cells with a calcium ionophore (A23187, 0.25 μg/ml; Foreman, Mongar & Gomperts, 1973) was markedly reduced (ID_{50} for meclofenamate

Table 1 Inhibition of histamine release from rat mast cells

		ID_{50} µg/ml			
Histamine liberator	*(µg/ml)*	*Indomethacin*	*Meclofenamate*	*PPP*	*PGE_2*
Compound 48/80	(0.16)	21.5	3.5	0 7	16.0
Phospholipase-A	(5.0)	13.5	2.0	—	—
Adenosine triphosphate	(200)	10.0	3.0	2.5	7 0
Antigen–egg albumen	(1000)	13.0	6.5	12.0	10.5

The concentration of inhibitor giving 50% reduction of histamine release (ID_{50}), following 5 min pre-incubation with mast cells, was determined from at least 5 experiments. Control histamine release, with the concentration of each liberator shown, was 30–40% of total histamine content of the cells

was 0.5 µg/ml). In contrast, the anti-inflammatory steroid, betamethasone (100 µg/ml), only slightly inhibited (18–25%) antigen- or 48/80-induced histamine release. Polyphloretin phosphate also reduced histamine release (Table 1) but was more potent than di-4-phloretin phosphate (ID_{50} against 48/80-induced release was 0.7 and 3.3 µg/ml respectively), unlike the relative potency of these compounds as either prostaglandin antagonists or as inhibitors of prostaglandin inactivation (Crutchley & Piper, 1974). Prostaglandin E_2 (PGE_2) reduced histamine release stimulated by the various liberators shown (Table 1) but exhibited a shallow dose-inhibition relationship; PGE_2 or its (15S)-15 methyl analogue (1 µg/ml) inhibited antigen-induced release by 20–30%.

These observations that non-steroid anti-inflammatory drugs inhibit histamine release supports the finding that indomethacin reduces mast cell degranulation (Taylor, Francis, Sheldon & Roitt, 1974). The mechanism underlying this inhibitory activity is not yet known, but may involve effects on cyclic AMP levels via phosphodiesterase inhibition, on membrane stability or on calcium-ion mobilization. Thus, assessment of a role for endogenous prostaglandins in mast cells is made difficult by these possible actions of aspirin-like drugs. However, the ability of prostaglandins to reduce mast cell histamine release could reflect a patho-physiological modulator role during anaphylaxis.

This work was supported by a grant from the M.R.C. to Professor G.P. Lewis. Prostaglandins were kindly supplied by the Upjohn Company, Kalamazoo.

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Steroid hormone receptors in brain and pituitary

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The following communication, presented to the British Pharmacological Society Meeting at the Welsh National School of Medicine, Cardiff (26–27th March, 1975), was inadvertently omitted from the Proceedings published in the June 1975 issue of the British Journal of Pharmacology.

L-Glutamate excitations on cortical neurones: influence of endogenous neuronal activity and halothane

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L-Glutamate applied microiontophoretically onto single cortical neurones invariably results in an increase in firing rate. This is usually attributed entirely to a postsynaptic effect, the possibility of a presynaptic contribution to the response usually being overlooked. These experiments were designed to explore this possibility more fully.

In the present study L-glutamate was applied microiontophoretically (Clarke, Forrester & Straughan, 1974) onto quiescent neurones in the cerebral cortex of urethane anaesthetized rats (1.8 g/kg). The electro-corticogram (E.Co.G.) of a urethane anaesthetized rat appears as intermittent surface positive bursts with high frequency activity on the plateaux separated by quiescent periods (Bindman, Lippold & Redfearn, 1964). On all of the 100+ neurones tested the neuronal firing induced by L-glutamate occurred initially only during the positive plateaux in the E.Co.G. (recorded at the cortical surface directly above the microelectrode) and as each response to L-glutamate developed the number of action potentials within each positive plateau increased. This firing pattern is similar to that shown by spontaneously active cells deep in the cortex. This suggests therefore that these L-glutamate induced excitations depend upon the presynaptic drive (depicted by the number of E.Co.G. positive plateaux) being facilitated by the postsynaptic depolarizing action of L-glutamate.

All depressants tested (including barbiturates, halothane and benzodiazepines), when superimposed upon this existing level of anaesthesia decrease the frequency of occurrence of these positive plateaux (Forrester & Gartside, 1975) and consequently they decrease the spontaneous activity of cortical neurones. On the 8 occasions when the animals were forced to breathe 1.5% halothane for between 5 and 10 min L-glutamate responses such as those described were consistently reduced as the frequency of occurrence of the positive plateaux fell, although the number of action potentials per E.Co.G. plateau at a given stage in the L-glutamate response remained unaffected. Blood pressure also remained unaffected.

When larger expelling currents of L-glutamate were applied (particularly when the depth of anaesthesia was increased and the periods between the positive plateaux in the E.Co.G. extended) then action potentials (with relatively constant interspike intervals) were generated between the positive plateaux. This firing pattern is typical of that induced by direct depolarizing currents injected into single cells (Calvin & Schwindt, 1972). There is a period of inhibition immediately following the plateaux during which there are no action potentials generated. Halothane does not inhibit the appearance of action potentials occurring between the plateaux, and often potentiates the overall response possibly because the number of inhibitory periods is reduced as the plateau frequency falls. Potentiation of glutamate-induced responses by halothane and other anaesthetics has been reported before (Catchglove, Krnjević and Maretić, 1972).

Hence it is concluded that endogenous excitation can contribute to the increase in firing rate evoked by L-glutamate and that by decreasing the endogenous excitatory drive the response to L-glutamate is altered in a manner determined by the power of the exogenous and initial endogenous input to the neurone.

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[1] P.A.F. is supported by an M.R.C. scholarship.

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TOLERANCE PATTERN OF THE ANOREXIGENIC ACTION OF AMPHETAMINES, FENFLURAMINE, PHENMETRAZINE AND DIETHYLPROPION IN RATS

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1 The tolerance pattern to anorectic drugs was studied in starved rats by measuring two consecutive 2 h food intakes.

2 There was a reduction in the first 2 h food intake with development of complete tolerance after fenfluramine and phenmetrazine, and of partial tolerance after amphetamine, (+)-amphetamine and diethylpropion.

3 During the second 2 h intake, the anorectic effect was transient after fenfluramine and diethylpropion; while there was an absolute increase in the intake after amphetamine and (+)-amphetamine.

4 A pair-feeding experiment revealed that the increase in the second 2 h food intake was not a direct effect of the drug but a consequence of the deficit in food intake during the preceding 2 hours.

5 There was an overall correlation between the food and water intake.

6 A significant loss in body weight was observed after amphetamine, fenfluramine and phenmetrazine but not after (+)-amphetamine or diethylpropion.

7 The results indicate that so-called tolerance to the anorexigenic effect of drugs is apparent rather than real and that the duration of food access is a determining factor. The body weight changes may be brought about by the metabolic effects of these drugs rather than their effect on food and water intake.

Introduction

Duration of food access as a determinant of the development of tolerance to the anorectic effect of amphetamine on repeated administration has been demonstrated in starved rats (Ghosh & Parvathy, 1973b). The anorectic effect was found to be restricted to the first 2 h with little evidence of tolerance, while there was an absolute increase in the second 2 h food intake. Blundell, Campbell, Lesham & Tozer (1975) have reported a short appetite suppressant effect following single administration of (+)-amphetamine consistent with the rapid clearance of the blood concentration in deprived rats.

In the present paper, we have analysed the effect of repeated administration of a few other known anorectic drugs in relation to food access as well as to body weight. In addition, an attempt has been made to discover the mechanism by which amphetamine produces an absolute increase in the second 2 h food intake. Some of the preliminary results were presented at the XXVI International Congress of Physiological Sciences, New Delhi (Parvathy & Ghosh, 1974).

Methods

Male albino rats (109–258 g) were housed individually in metabolism cages for three weeks in an ambient temperature between 28–32°C and subjected to a 16 h-dark–8 h-light cycle daily. They were fasted throughout (water allowed *ad libitum*) except for a period of 4 h at a fixed time each day when they were offered a weighed quantity of food pellets (Hindlever) and a measured quantity of water. The food and water consumed during the first and second 2 h periods were measured daily to the nearest 0.1 g and 0.5 ml respectively and recorded on the daily body weight basis. The body weight was measured daily to the nearest 1 g before offering food. In the first (pretreatment) week the animals were stabilized with regard to the food and water intake. At the beginning of the second (treatment) week groups of rats were randomly allocated to one of the following treatments: control—0.9% w/v NaCl solution (saline); amphetamine 5 mg/kg; (+)-amphetamine 2.5 mg/kg; fenfluramine 10 mg/kg; phenmetrazine 25 mg/kg and diethylpropion 10 mg/kg. The daily body weight was

Table 1 Effect of different anorexigens on 4 h food intake in fasted rats

Treatment	Dose (mg/kg)	No of animals	Pre-treatment week*	4 h food intake g/100 g body weight (mean ± s.e. mean) Treatment week days 1	2	3	4	5	6	7
Control (saline)	—	6	4.3±0.6	5.8±1.2	5.5±0.7	7.3±1.0	6.5±0.4	7.1±0.4	7.4±1.1	7.1±0.5
Amphetamine	5	6	5.7±0.8	3.3±0.6	3.4±0.6	3.7±0.9	5.1±0.8	4.7±0.5	5.6±0.6	5.7±0.7
(+)-Amphetamine	2.5	5	6.1±0.7	3.4±0.9	3.8±0.8	5.0±0.8	6.0±0.8	5.4±1.1	6.1±1.0	7.3±1.0
	2.5	5	6.3±0.6	3.4±0.5	4.3±0.5	5.4±0.7	6.2±0.3	5.8±0.6	6.9±0.8	6.9±0.7
	2.5	5	7.2±0.6	4.3±1.0	5.7±0.8	6.4±0.6	6.5±0.7	7.2±1.5	6.6±0.8	7.0±0.7
Fenfluramine	10	6	7.8±0.6	4.0±0.6	7.0±0.5	7.6±0.6	9.0±0.7	9.0±0.8	8.6±0.8	8.6±0.7
Phenmetrazine	25	6	6.6±0.6	4.5±0.5	6.0±0.9	5.9±0.6	6.3±0.7	6.6±0.6	7.3±0.7	7.4±0.7
Diethylpropion	10	6	7.2±0.4	1.4±0.5	2.7±0.9	3.8±1.2	2.8±1.0	4.4±0.8	3.8±0.7	3.7±0.6

Saline or drugs injected subcutaneously daily 30 min before food for 7 days. * Values during the pretreatment week are means of the mean daily values for individual rats pooled over the week

Table 2 Effect of different anorexigens on first 2 h food intake in fasted rats

Treatment	Dose (mg/kg)	No. of animals	Pre-treatment week*	First 2 h food intake g/100 g body weight (mean ± s.e. mean) Treatment week days 1	2	3	4	5	6	7
Control (saline)	—	6	3.1±0.6	4.4±1.0	3.9±0.5	5.3±0.8	4.2±0.4	4.8±0.4	5.2±0.6	4.9±0.4
Amphetamine	5	6	4.1±0.5	0.1±0.07	0.4±0.3	1.2±0.5	1.5±0.4	1.0±0.6	1.2±0.5	1.3±0.4
(+)-Amphetamine	2.5	5	4.4±0.4	1.9±0.6	1.7±0.5	2.1±0.6	2.7±0.2	2.2±1.1	2.2±0.9	2.7±1.2
	2.5	5	4.8±0.4	0.5±0.2	1.2±0.5	1.4±0.5	2.4±0.9	2.7±0.5	3.1±0.3	2.6±0.5
	2.5	5	4.8±0.4	1.6±0.8	2.5±1.0	2.4±0.5	2.5±0.6	3.1±0.7	2.8±0.7	2.8±0.6
Fenfluramine	10	6	5.1±0.5	2.7±0.4	4.8±0.3	4.9±0.3	5.9±0.5	6.2±0.6	6.3±0.6	6.3±0.5
Phenmetrazine	25	6	4.3±0.3	2.2±0.3	3.4±0.4	3.4±0.5	3.6±0.4	3.8±0.5	4.0±0.4	4.1±0.4
Diethylpropion	10	6	5.1±0.4	0.3±0.2	0.7±0.5	1.3±0.7	1.0±0.6	1.0±0.4	1.1±0.5	1.1±0.4

Saline or drugs injected subcutaneously daily 30 min before food for 7 days. * Values during the pretreatment week are means of the mean daily values for individual rats pooled over the week.

taken into consideration for calculation of the dose. The injections were given subcutaneously daily 30 min before food for 7 days. In addition to these, a pair-fed group was maintained in which the rats were allowed to consume the same quantity of food and water daily during the first 2 h period based on the average consumption by the (+)-amphetamine group on the previous day (24 h out of phase). During the second 2 h period they had free access to both food and water, the actual consumption of which was measured daily and recorded. All treatments stopped at the end of one week and the rats were observed for a further period of one (post-treatment) week.

Drugs

The following drugs were used: amphetamine sulphate (E. Merck), (+)-amphetamine sulphate (E. Merck); fenfluramine hydrochloride (Ponderax, Servier); phenmetrazine hydrochloride (Preludin, Boehringer Ingleheim) and diethylpropion hydrochloride (Tenuate, Merrell). The drugs were dissolved in saline and the doses are expressed in terms of the salt.

Statistical analysis

The statistical method employed in the analysis of results was Student's *t* test.

Results

Food intake

The 4 h food intakes following saline, amphetamine, (+)-amphetamine, fenfluramine, phenmetrazine and diethylpropion are shown in Table 1. The mean of the mean daily values for individual rats pooled over the pretreatment week provides the control value for each group. As can be seen, there is an increasing trend in the daily food intake in the saline-treated group. Following fenfluramine and phenmetrazine a similar trend is observed after an initial reduction in the food intake on the first day. However, after amphetamine and (+)-amphetamine intakes during the first three days of treatment were less, after which there was a complete recovery despite the continuation of the treatment. The diethylpropion-treated group showed a marked reduction in the food intake with partial recovery maintained through the rest of the treatment period.

Table 2 shows the first 2 h food intake following different treatments. The saline, fenfluramine- and phenmetrazine-treated groups all showed a similar trend to that seen at the 4 h intake. Amphetamine produced a marked reduction on the first day with a rapid but partial recovery by the third day which was maintained through the rest of the treatment period.

Table 3 Effect of different anorexigens on second 2 h food intake in fasted rats

Treatment	*Dose (mg/kg)*	*No. of animals*	*Pre-treatment week**	*Second 2 h food intake g/100 g body weight (mean ± s.e. mean) Treatment week days*						
				1	*2*	*3*	*4*	*5*	*6*	*7*
Control (saline)	—	6	1.2±0.1	1.4±0.6	1.6±0.4	2.0±0.4	2.3±0.4	2.3±0.3	2.2±0.6	2.2±0.5
Amphetamine	5	6	1.6±0.2	3.2±0.6	3.0±0.4	2.5±0.5	3.6±0.5	3.7±0.4	4.4±0.4	4.4±0.4
(+)-Amphetamine	2.5	5	1.7±0.3	1.7±0.4	2.1±0.4	2.9±0.5	3.3±0.6	3.2±0.7	3.9±0.6	4.6±0.6
	2.5	5	1.5±0.2	2.9±0.6	3.1±0.4	4.0±0.4	3.8±0.4	3.1±0.5	3.8±1.0	4.3±0.7
	2.5	5	2.3±0.2	2.6±0.4	3.2±0.4	4.0±0.5	4.0±0.6	4.1±1.1	3.8±0.2	4.2±0.8
Fenfluramine	10	6	2.6±0.2	1.3±0.2	2.2±0.3	2.7±0.4	3.1±0.7	2.8±0.4	2.3±0.2	2.3±0.3
Phenmetrazine	25	6	2.2±0.3	2.3±0.2	2.6±0.6	2.5±0.3	2.7±0.5	2.8±0.5	3.3±0.4	3.3±0.3
Diethylpropion	10	6	2.2±0.2	1.1±0.3	2.0±0.5	2.5±0.6	1.8±0.5	3.4±0.6	2.7±0.5	2.6±0.6

Saline or drugs injected subcutaneously daily 30 min before food for 7 days. * Values during the pretreatment week are means of the mean daily values for individual rats pooled over the week.

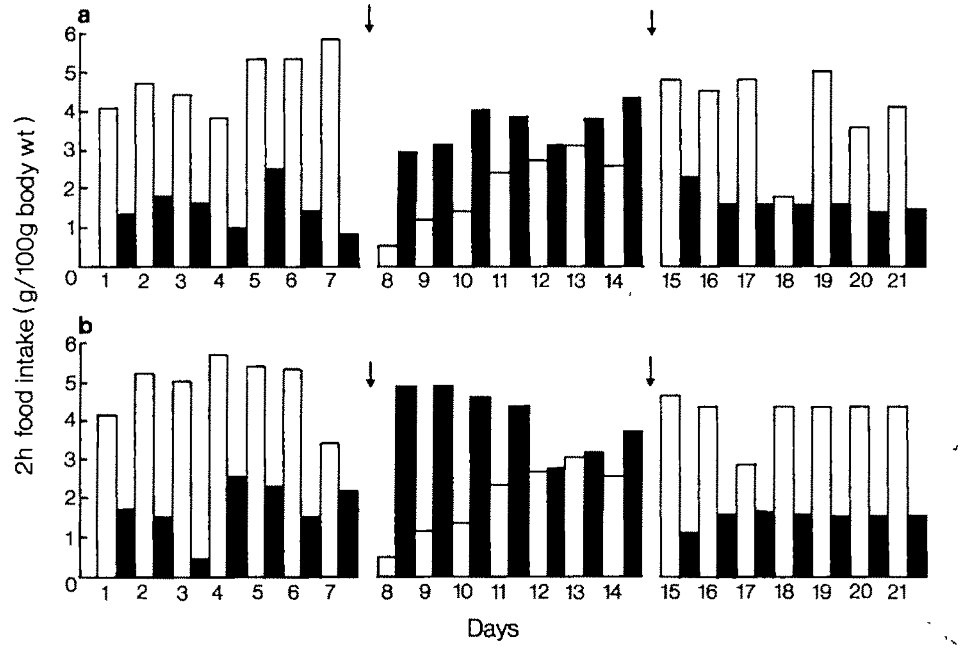

Figure 1 Effect of (a) (+)-amphetamine 2.5 mg/kg; (b) pair-feeding (first 2 h) on 2 h food intake in fasted rats. Open columns—first 2 h period, solid columns—second 2 h period. Drug or saline injected subcutaneously 30 min before food daily between the arrows Each column represents the mean observations from five rats.

(+)-Amphetamine produced a similar picture except that the reduction was much less than for amphetamine. Diethylpropion had an effect very similar to that of amphetamine.

The second 2 h food intake values are shown in Table 3. After fenfluramine and diethylpropion, a slight reduction on the first day was followed by recovery to almost control level. There was a trend towards a slight increase in the second 2 h food intake following saline as well as phenmetrazine throughout the treatment period. After amphetamine, there was a marked increase in the food intake even on the first day which tended to increase further through the rest of the treatment period. Following (+)-amphetamine, the effect was similar except for some delay in the initial increase of food intake.

The mean first and second 2 h food intake following (+)-amphetamine and in the pair-fed group are

Table 4 Difference in the food intake between the pretreatment and treatment weeks in fasted rats following different anorexigens

			Food intake g/100 g body weight (mean ± s.e. mean)					
			First 2 h			*Second 2 h*		
Treatment	*Dose (mg/kg)*	*No. of animals*	*Pretreatment week*	*Treatment week*	*Difference*	*Pretreatment week*	*Treatment week*	*Difference*
Control (saline)	—	6	3.1 ± 0.6	4.6 ± 0.5	+ 1.5**	1.2 ± 0.1	2.0 ± 0.3	+ 0.8*
Amphetamine	5	6	4.1 ± 0.5	1.0 ± 0.3	−3.1***	1.6 ± 0.2	3.6 ± 0.3	+ 2.0**
(+)-Amphetamine	2.5	5	4.4 ± 0.4	2.3 ± 0.5	−2.1*	1.7 ± 0.3	3.0 ± 0.4	+ 1.3*
Fenfluramine	10	6	5.1 ± 0.5	4.9 ± 0.2	−0.2	2.6 ± 0.2	2.3 ± 0.1	−0.3
Phenmetrazine	25	6	4.3 ± 0.3	3.3 ± 0.4	− 1.0*	2.2 ± 0.3	2.7 ± 0.3	+ 0.5
Diethylpropion	10	6	5.1 ± 0.4	0.9 ± 0.4	−4.2**	2.2 ± 0.2	2.2 ± 0.4	0
Pair-fed	—	5	—	—	—	1.6 ± 0.1	4.1 ± 0.3	+ 2.5**

Saline or drugs injected subcutaneously daily 30 min before food for 7 days. Values are means of the mean daily values for individual rats pooled over the respective weeks.
* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ (paired *t* test).

presented in Figure 1. (+)-Amphetamine produced a marked reduction in the first 2 h with only partial recovery, and an absolute increase in the second 2 h food intake during the treatment period. The pair-fed group also showed an increase in the second 2 h food intake, particularly during the first 4 days of treatment which was relatively greater than that after (+)-amphetamine, with a tailing off effect, although the intake remained higher than the pretreatment level. On withdrawal of the treatment the intake returned again to the pretreatment level.

The statistical significance of the changes in food intake are summarized in Table 4. The mean daily intake for each rat was calculated for the pretreatment and treatment weeks and differences analysed for significance by the paired *t* test. During the first 2 h period there was a significant increase in the food intake in the control group but a significant decrease in all the drug-treatment groups except for fenfluramine. During the second 2 h there was a significant increase in all the groups including pair-fed but excluding fenfluramine-, phenmetrazine- and diethylpropion-treated groups.

Water intake

In general, the water intake followed the pattern of food intake with different treatments. There was a significant decrease in the first 2 h water intake after all the drugs including fenfluramine (Table 5). There was also a significant increase in the second 2 h water intake in all the groups except diethylpropion and fenfluramine, the latter producing a significant decrease.

Body weight

The changes in body weight are summarized in Table 6. All the rats lost weight to a varying extent (1.3 to 4.9%) at the end of the pretreatment week. However, the loss at the end of the treatment week was significantly greater after amphetamine, fenfluramine and phenmetrazine. Following (+)-amphetamine there was loss in one series and a gain in two other series during the treatment week, but none of these values was statistically significant. Following diethylpropion, the loss during the treatment week, though apparently greater, was not statistically significant. However, in the pair-fed group there was a significant gain in body weight during the treatment week.

Discussion

The highly potent but short-lived effect (first 2 h) of amphetamines could be explained by the rapid clearance of the drugs as demonstrated by Blundell *et al.* (1975). Similarly the prolonged anorectic effect of fenfluramine (second 2 h) could be explained by the slower rate of clearance of fenfluramine as well as its conversion to another active metabolite, norfenfluramine, reported by the same workers. Complete tolerance to the anorectic effect during the first 2 h food intake was observed after repeated administration of fenfluramine and phenmetrazine, while after amphetamine, (+)-amphetamine and diethylpropion the tolerance was only partial. The monitoring of the daily blood level of these drugs during this period

Table 5 Difference in the water intake between the pretreatment and treatment weeks in fasted rats following different anorexigens

			Water intake ml/100 g body weight (mean ± s.e. mean)					
			First 2 h			*Second 2 h*		
Treatment	*Dose (mg/kg)*	*No. of animals*	*Pretreatment week*	*Treatment week*	*Difference*	*Pretreatment week*	*Treatment week*	*Difference*
Control (saline)	—	6	4.0 ± 0.8	5.5 ± 0 8	+1.5	3.5 ± 0.5	3.5 ± 0.4	0
Amphetamine	5	6	4.5 ± 0.7	0.5 ± 0.3	-4.0^{**}	2.5 ± 0.3	6.0 ± 0.6	$+3.5^{**}$
(+)-Amphetamine	2.5	5	5.0 ± 0.7	2.5 ± 0 7	-2.5^{**}	2.5 ± 0.6	6.0 ± 0.7	$+3.5^{**}$
Fenfluramine	10	6	7.5 ± 0.8	5.0 ± 0.4	-2.5^{*}	5.0 ± 0.6	4.0 ± 0.4	-1.0^{*}
Phenmetrazine	25	6	5.5 ± 0.6	2.5 ± 0.7	-3.0^{**}	4.5 ± 0.3	7.0 ± 0.7	$+2.5^{*}$
Diethylpropion	10	6	6.5 ± 0.5	0.5 ± 0.2	-6.0^{***}	3.0 ± 0.2	4 0 ± 0.7	+1.0
Pair-fed	—	5	—	—	—	2.5 ± 0.2	5 0 ± 0.4	$+2.5^{***}$

Saline or drugs injected subcutaneously daily 30 min before food for 7 days. Values are means of the mean daily values for individual rats pooled over the respective weeks.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ (paired *t* test).

might throw some light on the mechanism of the development of tolerance. An absolute increase in the second 2 h food intake presumably contributed towards the development of complete tolerance with respect to amphetamine and (+)-amphetamine when total 4 h food intake was recorded. The pair-feeding experiment suggests that there might be little pharmacological tolerance to amphetamines in the strict sense, but that the anorectic effect is balanced by the increasing deficit of food. It further suggests that there is some carry-over suppressant effect of (+)-amphetamine on the second 2 h intake, specially during the early days of the treatment period.

There was an overall correlation between the food and water intake which was expected because most of the water the rats drink is needed to digest food (Bolles, 1961). Fenfluramine and phenmetrazine, however, had more effect on water than on food intake.

It is interesting that the pair-fed rats gained body weight significantly while the control rats failed to gain any weight. The difference between the two groups was that the percentage loss of body weight during the pretreatment week was less with the pair-fed group. Another difference was that the second 2 h food intake was greater in the pair-fed group than the control group. These differences, however, cannot explain the gain in weight in the pair-fed group and further studies are required to elicit its mechanisms. It should be recognized that rats on a 4-h feeding schedule are to some extent starved and were probably well below normal weight at the start of the treatment week.

The results on body weights following anorexigens are also interesting when compared with their effect on food intake. With the exceptions of (+)-amphetamine and diethylpropion, all drugs produced a significant loss in body weight despite development of tolerance to their anorectic effect. Tormey & Lasagna (1960) observed a similar weight loss following amphetamine despite the development of tolerance. However, diethylpropion is the only drug to which no appreciable tolerance developed and yet it failed to produce significant weight loss. The situation was opposite with fenfluramine. It produced a significant weight loss although its anorectic effect was short lived. It is rather surprising that (+)-amphetamine, affecting food and water intake like amphetamine, failed to produce any significant loss in body weight in starved rats on repeated trials, while amphetamine produced a significant loss. Abdallah & White (1970) also failed to obtain a significant change in body weight in unstarved rats following (+)-amphetamine, while Alphin & Ward (1969), Lawlor, Trivedi & Yelnosky (1969) and Magour, Coper & Faehndrich (1974) reported a loss. The differential effects of (+)- and (±)-amphetamine on body weight in the present series, where the experimental conditions are the same, are opposite to those that would be predicted and are difficult to explain. Body weight is of course the sum of many components which may well vary independently. For instance the effect of amphetamine on body weight could be explained in terms of its adipokinetic action (Opitz, 1970), which is independent of its anorectic effect. Fenfluramine has been shown to increase peripheral glucose utilization (Butterfield & Whichelow, 1968) together with an inhibition of lipogenesis and increase in lipolysis (Marsh & Bizzi, 1972). A significant gain in body weight without any significant change in food or water intake in starved rats has also been reported following

Table 6 Difference in the body weight between the pretreatment and treatment weeks in fasted rats following different anorexigens

			Per cent loss of body weight		
Treatment	*Dose (mg/kg)*	*No. of animals*	*Pretreatment week*	*Treatment week*	*Significance of difference*
Control		6	4 2	4.7	NS
Amphetamine	5	6	4.7	11.8	$P<0.05$
	5	6	4.0	11.8	$P<0 05$
(+)-Amphetamine	2.5	4	3.4	4.3	NS
	2.5	5	2.0	+0.5*	NS
	2.5	5	2.8	+1.9*	NS
Fenfluramine	10	6	3.4	13.8	$P<0.01$
Phenmetrazine	25	6	4.9	15.6	$P<0.01$
Diethylpropion	10	6	2.3	9 1	NS
Pair-fed	—	5	1.3	+3.8*	$P<0.01$

Drugs injected subcutaneously daily 30 min before food for 7 days. Values represent the difference between first and seventh day body weight expressed as per cent of the first day weight in the week. * Represents gain in body weight.

Significance of difference between the two weeks by Student's paired *t* test.

cyproheptadine (Ghosh & Parvathy, 1973a). The effect of a drug on metabolism rather than, or in addition to, its effect on food and water intake may be a factor in explaining the mechanism of the alteration of body weight.

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OESTROGENIC, ANTI-OESTROGENIC AND FERTILITY EFFECTS OF SOME TRIPHENYLETHANES AND TRIPHENYLETHYLENES RELATED TO ETHAMOXYTRIPHETOL (MER 25)

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1 Five triphenylethylenes, a triphenylethane and a triphenylethanol, carrying methyl substituents ortho to one or both of the ring oxygen functions, have been examined for oestrogenic, and anti-oestrogenic activity in mice, and three of the compounds, α-[4-(β-diethylaminoethoxy)-3, 5-xylyl]-α-phenyl-β-4-methoxyphenyl-ethanol (IV), α′-[4-(β-diethylaminoethoxy)-3, 5-xylyl]-4-methoxy-bibenzyl (V) and α′-[4-(β-diethylaminoethoxy)-3, 5-xylyl]-4-methoxy-stilbene (VI), were tested for their effects on fertility in mice.

2 Orthomethylation reduces oestrogenic and/or anti-oestrogenic activity compared with the reported activities of non-methylated analogues.

3 The anti-oestrogenic ethamoxytriphetol (MER 25) reduced fertility in mice whereas its inactive dimethylated analogue (IV) was ineffective. The weakly active anti-oestrogens, V and VI, did not affect fertility in mice.

Introduction

Since the report of ethamoxytriphetol (MER 25) (Lerner, Holthaus & Thompson, 1958) several triphenylethylene or triphenylethane derivatives have been investigated for anti-oestrogenic and possible anti-fertility activity e.g. MRL 41 (Holtkamp, Davis & Rhodes, 1961), MRL 37 (Barnes & Meyer, 1962), ICI 46,474 (Harper & Walpole, 1966) and CN-55,945 (Callantine, Humphrey, Lee, Windsor, Schottin & O'Brien, 1966), but unlike MER 25 all possess some form of oestrogenic activity (Terenius, 1971).

The introduction of methyl groups *ortho* to the phenolic hydroxyls in ψ-diethylstilboestrol and diethylstilboestrol reduces oestrogenic activity and produces compounds with local anti-oestrogenic activity but no systemic anti-oestrogenic activity (Clark & O'Donnell, 1965; Clark & McCracken, 1971).

In the search for non-oestrogenic, systemic anti-oestrogens the effect of ring methylation *ortho* to ring oxygen in several triphenylethylene and triphenylethane derivatives has been studied.

A preliminary account of some of this work was presented to the British Pharmacological Society Meeting (Clark, Evans & Jordan, 1973).

Methods

The synthesis and identification of the test compounds (I–VII) shown in Figure 1 will be reported elsewhere (microanalyses and spectral data for the test compounds are in accord with the given structures). MER 25 was supplied by Wm. S. Merrell Co. Cincinnati, Ohio, U.S.A. Mice were of the Tuck No. 1 strain.

Oestrogenic and anti-oestrogenic properties

The preparation of solutions and experimental procedures for the immature mouse uterine weight test and the Allen-Doisy test have been described previously (Clark & McCracken, 1971). In the immature mouse uterine weight test, mice were injected (s.c.) with 17β-oestradiol and/or test compounds on three consecutive days and on the morning of the fourth day, animals were killed and uteri were dissected out and weighed wet. The levels of significance between groups were determined by Student's *t* test. For oestrogenic activity test groups were compared with arachis oil controls and for anti-oestrogenic activity with the related 17β-oestradiol treated group. In the Allen-Doisy test 17β-oestradiol

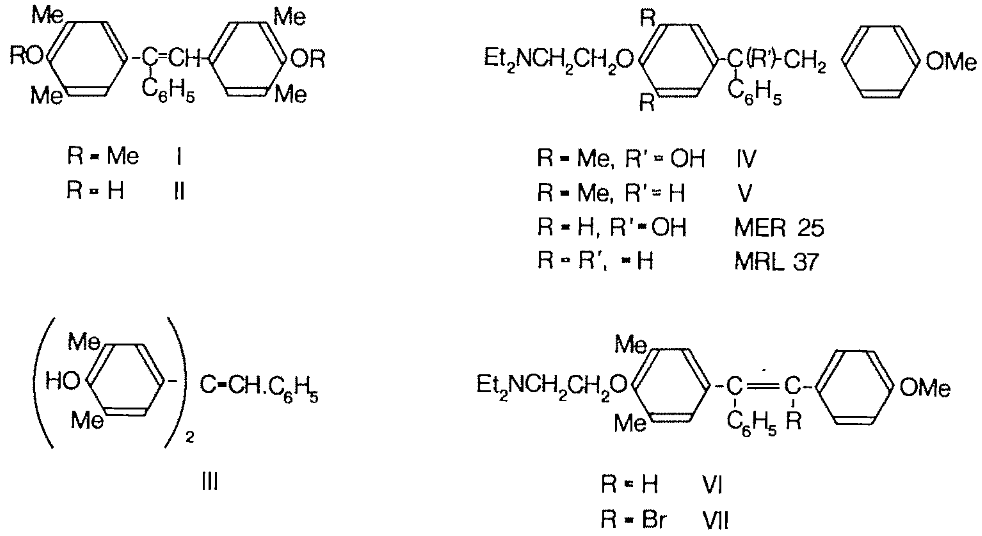

Figure 1 The chemical structures of compounds described in the text.

and/or test compounds were administered (s.c. in oestrogen tests and intravaginally in anti-oestrogen tests) to ovariectomized mice on two consecutive days. Vaginal smears were taken twice on day 3 in intravaginal assays or on days 3 and 4 in systemic assays.

Antifertility properties

Mature female mice were randomly distributed into groups of ten. Five mature male mice were admitted to each cage for four days. Throughout this period and for one further day female mice were treated daily (s.c.

Table 1 Non-basic compounds Mean uterine weights (mg) for groups of immature female mice treated with 0, 0.03 or 0.06 μg 17β-oestradiol, increasing doses of compounds I, II, III or 17β-oestradiol (0.03 or 0.06 μg) in combination with increasing doses of compounds I, II or III.

Compound	*Total dose of compound (mg) per mouse*	*Total dose of 17β-oestradiol (μg) per mouse* 0	0.03	0.06
I	0	12.42±0.84	32.68±1.89	47.19±3.15
	1.0	14.49±1.54	32.51±2.63	46.43±5.6
	2.0	17.28±2.05	30.35±2.1	49.32±4.74
II	0	17.98±1.35	27.95±1.77	45.55±3.96
	1.0	20.14±2.02	30.47±2.56	45.07±2.98
	2.0	21.40±0.82*	31.58±2.79	47.70±5.02
	4.0	24.49±1.06**	30.40±1.98	42.52±3.16
III	0	14.63±1.00	31.89±2.03	46.36±2.24
	0.5	–	28.93±2.17	44.14±2.54
	1.0	–	30.45±2.14	36.04±2.17**
	2.0	–	29.23±2.11	42.05±2.73
	0	14.27±0.91	30.88±1.11	56.90±2.02
	0.5	14.61±1.22	–	–
	1.0	14.67±1.30	–	–
	2.0	14.65±0.60	–	–
	4.0	17.12±1.15	–	–

Uterine weights (mg) are given ±s e. mean. The total dose per animal was administered subcutaneously in three daily subdoses. Each subdose was dissolved in 0.05 ml arachis oil (10 mice per group).
Levels of significance (Student's t test) when compared with related control: *$P<0.05$; **$P<0.01$.

administration) with the test compounds dissolved in 0.05 ml arachis oil or arachis oil (0.05 ml) alone. Doses of compounds IV and V and MER 25 were 1.0 mg daily and compound VI 0.5 and 1.0 mg daily. After ten days each female was caged individually and at birth litter numbers were recorded.

Results

The test compounds (Figure 1) were examined for oestrogenic and anti-oestrogenic properties by the immature mouse uterine weight test (Tables 1, 2, 3) and compounds I, II, IV, V, VI and VII were also examined in the Allen-Doisy test (Table 4).

Doses up to 2.0 mg of compound I neither increased the uterine weight of immature mice when administered alone nor decreased it when administered simultaneously with 17β-oestradiol (Table 1). Although 2.0 and 4.0 mg of the related diphenolic compound (II) produced significant ($P < 0.05$ and $P < 0.01$ respectively) increases in uterine weight when compared with controls, neither these nor a 1 mg dose suppressed the increase in uterine weight produced by 17β-oestradiol (Table 1). Compound III, a structural isomer of II, neither produced increases in uterine weight at doses up to 4.0 mg nor antagonized in a dose-dependent manner, the effects of 17β-oestradiol, although 1.0 mg of compound III produced a significant reduction ($P < 0.01$) in the increase in uterine weight produced by 0.06 μg 17β-oestradiol (Table 1).

Amongst the aminoethoxy derivatives (Table 2) compounds IV and V were non-oestrogenic at doses up to 8.0 mg whereas VI and VII produced increases in the immature mouse uterine weight, compound VII being approximately four times more active than its non-brominated analogue (VI). Both compounds VI and VII are partial agonists since the maximum response produced by VII was approximately 85%,

Table 2 Oestrogenic activity of amino-ethoxy derivatives. Mean uterine weights (mg) for groups of immature female mice treated with increasing doses of 17β-oestradiol or increasing doses of Compounds IV, V, VI and VII.

Compound	*Total dose of compound (mg) per mouse*	*Total dose of 17β-oestradiol (μg) per mouse*	*Mean uterine weight (mg)*
IV	0	0	13.82 ± 1.13
	0.5	0	12.26 ± 0.70
	2.0	0	13.47 ± 0.69
	8.0	0	12.82 ± 0.90
	0	0.03	32.19 ± 1.23
	0	0.06	49.56 ± 2.54
V	0	0	12 64 ± 1.11
	1.0	0	12.02 ± 0.59
	2.0	0	11.77 ± 0.88
	4.0	0	11.99 ± 0.80
	8.0	0	13.16 ± 0.61
	0	0.03	32 49 ± 1.11
	0	0.06	46.68 ± 1.58
VI	0	0	17.65 ± 1.15
	2.0	0	21.91 ± 1.11*
	4.0	0	31.44 ± 1.17**
	8.0	0	37.79 ± 1.46**
	0	0.02	24.33 ± 0.96
	0	0.04	38.76 ± 1.56
	0	0.08	57.89 ± 1.27
VII	0	0	14.16 ± 0 78
	0.5	0	25.11 ± 1.35**
	1.0	0	37.91 ± 1.71**
	2.0	0	44.55 ± 1.75**
	0	0.02	25 57 ± 0.75
	0	0.04	41 30 ± 1.39
	0	0.08	57.47 ± 1.08

Uterine weights (mg) are given ±s.e. mean. The total dose per animal was administered subcutaneously in three daily subdoses Each subdose was dissolved in 0 05 ml arachis oil (10 mice per group).

Levels of significance (Student's t test) of test compounds when compared with related arachis oil controls: *$P < 0.01$; **$P < 0.001$.

and that by VI approximately 60% of that which could be obtained with 17β-oestradiol (Figure 2).

In the immature mouse uterine weight test (Table 3) the anti-oestrogenic properties of MER 25 were confirmed but none of the novel aminoethoxy compounds (IV, V, VI, and VII) was more effective than MER 25. Compound IV, the most closely related to MER 25, was inactive as an anti-oestrogen at doses up to 4.0 mg whereas doses of 2.0 mg of compounds V or VI produced highly significant ($P < 0.001$) decreases in the uterine response to 0.06 µg 17β-oestradiol. Compound VI is approximately twice as anti-oestrogenic as V (Figure 3). Compound VII at sub-oestrogenic doses increased ($P < 0.05$) rather than decreased the uterine weight response to low doses (0.03 µg) of oestradiol (Table 3).

In the Allen-Doisy tests, compounds I, II, IV, V, VI and VII were neither oestrogenic nor anti-oestrogenic at the doses tested (Table 4) whether administered intravaginally or subcutaneously.

The effects of anti-oestrogenic doses of compounds V and VI on reproduction in female mice were compared with those produced by MER 25 (Table 5). Compound IV was similarly tested to determine whether a lack of anti-oestrogenic activity in a compound closely related to MER 25 would affect anti-fertility activity.

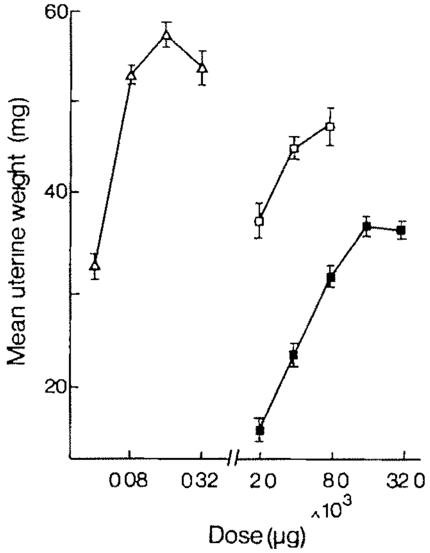

Figure 2 Mean uterine weights (mg) for groups of immature female mice treated with increasing doses of 17β-oestradiol (Δ), compound VI (■) or compound VII (□). Vertical lines show s.e. mean. The total dose per animal was administered subcutaneously in three daily subdoses, and each subdose was dissolved in arachis oil (0.05 ml).

Table 3 Anti-oestrogenic activity of amino-ethoxy derivatives. Mean uterine weights (mg) for groups of immature female mice treated with 0, 0.03 or 0.06 µg 17β-oestradiol alone or in combination with increasing doses of MER 25, IV, V, VI or VII.

Compound	*Total dose of compound (mg) per mouse*	*Total dose 17β-oestradiol (µg) per mouse* *0*	*0.03*	*0.06*
MER 25	0	12.12 ± 0.82	29.09 ± 0.91	46.18 ± 1.25
	0.5	–	23.27 ± 1.04**	25.67 ± 0.92**
	1.0	–	17.91 ± 0.81**	22.01 ± 0.88**
	2.0	–	14.59 ± 0.43**	17.26 ± 0.77**
IV	0	9.64 ± 0.43	31.75 ± 1.90	41.89 ± 2.01
	1.0	–	26.93 ± 2.07	38.66 ± 2.53
	2.0	–	29.42 ± 1.44	38.39 ± 2.48
	4.0	–	27.56 ± 1.74	40.09 ± 1.71
V	0	13.80 ± 1.02	34.73 ± 1.60	45.70 ± 1.36
	0.5	–	31.65 ± 1.48	40.83 ± 1.45
	1.0	–	30.14 ± 1.78	39.25 ± 1.67
	2.0	–	28.65 ± 1.13*	36.19 ± 1.65**
VI	0	15.14 ± 1.73	36.85 ± 1.14	53.08 ± 1.86
	0.5	–	32.27 ± 0.62*	44.89 ± 2.80
	1.0	–	29.33 ± 1.70*	42.57 ± 1.77**
	2.0	–	27.60 ± 0.90*	34.99 ± 0.99**
VII	0	13.6 ± 0.93	29.25 ± 1.16	55.37 ± 1.64
	0.05	–	31.30 ± 1.51	52.51 ± 2.37
	0.1	–	33.92 ± 1.61	60.15 ± 2.63
	0.2	–	39.99 ± 1.26**	54.28 ± 1.85

Uterine weights (mg) are given ± s.e. mean. The total dose per animal was administered subcutaneously in three daily sub-doses. Each sub-dose was dissolved in 0.05 ml arachis oil (10 mice per group).

Levels of significance (Student's *t* test) when compared with related 17β-oestradiol-treated controls: *$P < 0.01$; **$P < 0.001$.

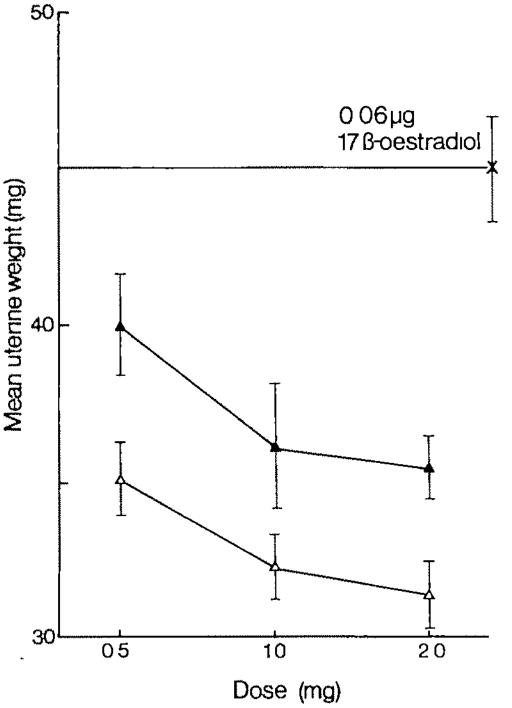

Figure 3 Mean uterine weights (mg) for groups of immature female mice treated with 0.06 µg 17β-oestradiol alone or in combination with increasing doses of compound V (▲) or VI (△). The total dose per animal was administered subcutaneously in three daily subdoses and each subdose was dissolved in arachis oil (0.05 ml)

Five of the females receiving compound V became pregnant. Three produced normal healthy litters, one produced a single underweight offspring which died 3 h after birth and the fifth ate the young at birth (the number and size of the progeny are unknown as the births occurred at night). In no test group was the number of pregnancies significantly different from control and only in the group treated with MER 25 was the mean size of the litters significantly smaller ($P < 0.05$). Compound VI, with both oestrogenic and anti-oestrogenic properties produced no consistent decrease in fertility.

Discussion

Clark & McCracken (1971) reported that ring-tetramethylation *ortho* to ring oxygen in diethylstilboestrol reduced the oestrogenic activity and endowed the molecule with anti-oestrogenic activity when administered intravaginally with 17β-oestradiol. Unfortunately the compound *aa*′-diethyl-3,3′, 5,5′-tetramethylstilboestrol was oestrogenic in the immature mouse uterine weight test although large doses were autoinhibitory.

It was hoped that the introduction of methyl groups *ortho* to ring oxygen in hydroxylated triphenylethylenes might similarly decrease oestrogenic activity but without an associated decrease in the affinity for the oestrogen receptor (Jensen & Jacobsen, 1962) thus producing a systemic anti-oestrogen. The parent triphenylethylenes chosen to test the effects of ring methylation, viz. α-phenyl-stilboestrol and α-phenyl-β,β-di(*p*-hydroxyphenyl)ethylene are both oestrogenic, subcutaneous MED_{50} for vaginal cornification in mice being respectively 15 and 9 µg (Emmens, 1940/41). Tetramethylation to produce compounds II and III dramatically reduced oestrogenic potencies and only compound II was weakly oestrogenic at doses above 2 mg in the immature mouse uterine weight test. Interpretation of these results was complicated by the ease of oxidation of the compounds. The chemically stable dimethyl ether of II, compound I, was non-oestrogenic at 2.0 mg. The loss of oestrogenic activity was also accompanied by a lack of ability to antagonize the systemic effects of 17β-oestradiol on

Table 4 The maximum total doses of compounds administered to ovariectomized mice either subcutaneously in arachis oil (two daily sub-doses each in 0.05 ml) or intravaginally in 2% aqueous Tween 80 (two daily sub-doses each in 0.01 ml) to test for oestrogenic or anti-oestrogenic activity by the Allen-Doisy technique.

Compound	*Subcutaneous administration total dose (mg)* *Oestrogenic*	*Anti-oestrogenic*	*Intravaginal administration total dose (µg)* *Oestrogenic*	*Anti-oestrogenic*
I	—	8.0	—	4.0
II	—	—	4.0	—
IV	—	—	8.0	9.0
V	2.0	2.0	—	32.0
VI	2.0	2.0	8.0	8.0
VII	2.0	—	4.0	—

In anti-oestrogenic tests the total dose of 17β-oestradiol was either 0.08 µg subcutaneous or 8×10^{-4} µg intravaginally. No compound exhibited significant activity in any test.

Table 5 Number of litters per group and the numbers of young per litter following the daily subcutaneous administration for five days of various doses of test compounds (IV, V, VI, MER 25) in arachis oil (0.05 ml) or arachis oil alone (0.05 ml) to mature female mice (10 mice per group)

Experiment	*Daily treatment*	*Number of pregnancies*	*Number per litter*
1	Arachis oil	6	12, 13, 8, 10, 14, 12
	1.0 mg V	5	16, 11, 10, 1*, 0**
2	Arachis oil	6	13, 11, 10, 12, 11, 13
	1.0 mg MER 25	4	7, 9, 8, 2†
	1.0 mg IV	10	13, 16, 10, 12, 11, 11, 12, 11, 12, 11
3	Arachis oil	5	7, 10, 8, 12, 11
	0.5 mg VI	4	11, 8, 11, 11
	1.0 mg VI	8	10, 10, 12, 10, 10, 7, 11, 4
	1.0 mg IV	9	11, 9, 8, 12, 8, 8, 11, 13, 13

Mature male mice (5 mice per group) were introduced on day one and removed on day five of treatment. * Died 3 h after birth; ** eaten by mother (see text).

† Comparison of mean litter size with control, $P < 0.05$ (*t* test).

the uterus or vagina. In contrast, the aminoethoxy compounds (IV, V, VI and VII), provided an interesting variety of biological properties. The anti-oestrogenic and the antifertility activity shown by MER 25 confirmed the findings of other workers (Lerner, *et al.* 1958; Martin, Emmens & Cox, 1960) and provided a reference with which to compare the activities of these compounds.

The established non-steroidal systemic anti-oestrogens MER 25, MRL 37, MRL 41, ICI 46,474, CN-55,945 and U 11,100A all possess an alkyl-aminoethoxy side-chain, and Lednicer, Lyster & Duncan (1967), after a consideration of structure-activity relationships amongst compounds related to U-11,100A, suggested that the presence of a basic group at a given position in space is required to obtain a molecule that will antagonize the effects of concurrent oestrogen administration. Emmens, Collins, Hobbs, Miller & Owen (1969) have further suggested that the essential feature of the side-chain is its polarity rather than its basicity and that its importance lies in modifying the physical properties of the molecule.

In the present investigation, the introduction of two methyl groups *ortho* to the *N,N*-diethylaminoethoxy side-chain will alter, by steric hindrance, the conformational possibilities of the molecule and the side-chain will no longer be able to lie in the plain of the aromatic ring, but will take up a position approximately at right angles to it (Clark & Williams, 1967; Coggan, McPhail & Roe, 1969). This conformational change, as well as the electron donating effects of the methyl groups, will lead to an increase in the electron density of the ether oxygen and, via an inductive mechanism, a change in the electron density of the tertiary amine group.

This type of substitution in MER 25 is clearly disadvantageous since the resultant compound, (IV), is neither oestrogenic nor anti-oestrogenic, and lacks the anti-fertility activity of the anti-oestrogenic MER 25.

The related triphenylethylene (VI) was both oestrogenic and anti-oestrogenic in the uterine weight test; thus the inability of compound IV to provide effective receptor combination can be overcome by alterations elsewhere in the molecule. Although the lack of antifertility activity of anti-oestrogenic doses of compound VI was unexpected, Collins, Hobbs & Emmens (1971) have described a similar effect with a closely related triphenylethylene.

The introduction of a bromine atom at the double bond of VI to produce VII increased the oestrogenic potency. This is consistent with previous reports of this type of chemical modification (Emmens, 1947).

Compound V, which bears the same structural relationship to MRL 37 as IV does to MER 25, retained some anti-oestrogenic activity without a resultant increase in oestrogenic properties although its performance in the antifertility test did not produce a consistent inhibitory result and it is probably less active than MRL 37 (Emmens, Humphrey, Martin & Owen, 1967). The successful litters from both control and compound V-treated mothers continued to grow normally during the two weeks following birth with the growth rates depending more upon litter size (small litters, faster growth) than the treatment received during conception.

None of the compounds tested was either oestrogenic or anti-oestrogenic whether administered intravaginally or subcutaneously in the Allen-Doisy test. This inactivity may have been a reflection of the doses used, although Emmens, Cox & Martin (1960) reported a similar type of insensitivity by the mouse vagina to the subcutaneous or intravaginal administration of MER 25. Indeed, the simultaneous administration of compound VI to ovariectomized and immature female mice produced parallel increases in uterine weights whilst vaginal smears of the ovariectomized mice remained negative.

In summary, therefore, it is clear that the introduction of ring methyl groups into triphenylethylenes and triphenylethanes *ortho* to phenolic hydroxyls or alkyl amino ethoxy side-chains is a disadvantageous procedure which provided no compounds with any apparent advantages over the established triphenyl ethylene-triphenyl ethane types of anti-oestrogen.

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DUAL EFFECTS OF ASPIRIN IN GUINEA-PIG LUNGS

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1 Dual effects of aspirin were demonstrated in guinea-pig lungs: (a) aspirin (3.3 mg/kg i.v.) antagonized bronchoconstriction induced by slow reacting substance of anaphylaxis (SRS-A); (b) aspirin produced bronchoconstriction when injected in the presence of propranolol into guinea-pigs *in vivo* at 330 mg/kg, or into guinea-pig isolated lungs *in vitro* as a 4% solution (40 mg/ml).

2 The severity of bronchoconstriction following administration of aspirin was directly related to the degree of β-adrenoceptor blockade and to the age of the guinea-pigs. Aspirin-induced bronchoconstriction was prevented *in vivo* and *in vitro* by atropine and it could be reversed *in vivo* by atropine. Aspirin-induced bronchoconstriction was not inhibited by vagotomy or phenoxybenzamine.

3 These data suggest that the mechanism involved in aspirin-induced bronchoconstriction may be local cholinergic stimulation and that reduced β-adrenergic drive may be a predisposing factor.

Introduction

Hypersensitivity to aspirin in man has been described as a triad of symptoms: skin reactions, nasal polyps, and the most serious symptom, asthma. The estimated incidence of hypersensitivity to aspirin ranges from 0.2% in the total population (Giraldo, Blumenthal & Spink, 1969), to 10–20% in the asthmatic population (Von Maur, Adkinson, Van Metre, Marsh & Norman, 1974).

Other analgesic and/or anti-inflammatory agents, such as mefenamic acid, indomethacin, paracetamol and phenylbutazone may also produce asthmatic episodes in man (Samter & Beers, 1968; Smith, 1971; Szczeklik, Gryglewski & Czerniawska-Mysik, 1975; Delaney, 1975). Paradoxically, most of these agents counteract bronchoconstriction induced in experimental animals by slow reacting substance of anaphylaxis (SRS-A) or bradykinin (Berry & Collier, 1964). The numerous attempts to elucidate the mechanism of aspirin-induced asthma have not revealed specific immunological reactions due to aspirin itself (Pearson, 1963; Giraldo *et al.*, 1969; Yurchak, Wicher & Arbesman, 1970; Vatanasuk, Hornbrook & Kohler, 1971; Schlumberger, Lobbecke & Kallos, 1974). However, de Weck (1971) has suggested that the anhydride of aspirin could act as an immunogen. Samter & Beers (1968) have postulated that altered responses of peripheral chemoreceptors initiate a series of reflexes in which mild analgesics act as agonists rather than antagonists. Lately, inhibition of biosynthesis of prostaglandins by aspirin and other mild analgesics has been associated with their ability to induce asthmatic episodes (Szczeklik *et al.*, 1975). However, there is little clinical or experimental evidence suggesting that prostaglandins are directly involved in aspirin-induced bronchoconstriction (Von Maur *et al.*, 1974; Delaney, Smith & Silver, 1975). Fisherman & Cohen (1974), measuring mainly bleeding time, found that patients intolerant to aspirin were over-responsive to α-adrenergic stimulation.

There is general agreement that intolerance to aspirin is more frequent in middle-aged than in juvenile asthmatics, and that the mechanism of intolerance to aspirin is not immunological.

In order to study the different aspects of aspirin-induced asthma, a model of aspirin-induced bronchoconstriction was developed in guinea-pigs. This paper describes a possible mechanism of aspirin-induced bronchoconstriction in guinea-pigs, and compares the bronchoconstrictory effects of aspirin with its ability to inhibit SRS-A-induced bronchoconstriction in guinea-pigs.

Methods

Hartley strain guinea-pigs of either sex weighing 250 to 800 g were used. The weight range was kept within 150 g in any given experiment.

Measurement of bronchoconstriction

Bronchoconstriction induced by SRS-A. SRS-A was harvested as described by Orange & Austen (1968).

Briefly, rats were passively sensitized by intraperitoneal injections of rabbit anti-bovine serum albumen (BSA) antibody. Two hours later, 10 mg of BSA in 5 ml of Tyrode solution was injected intraperitoneally and the peritoneal fluid harvested 5 min later. This fluid constituted the crude SRS-A preparation; it contained an insignificant amount of or no histamine.

Guinea-pigs were anaesthetized with urethane (1.5 g/kg i.p.) and the trachea and jugular vein were cannulated. Respiration was maintained with a rodent pump at 40 strokes/min; the stroke volume was adjusted to guinea-pig weight, and the resistance to pulmonary inflation monitored continuously (Konzett & Roessler, 1940). Immediately after the start of the artificial respiration many of the guinea-pigs were fairly refractory to bronchoconstrictory stimuli. The reactivity of the respiratory tract was therefore repeatedly checked by intravenous injections of histamine 5 µg/kg. When this increased the resistance to inflation by more than 15 mmHg the contractile reactivity of the respiratory tract was considered satisfactory.

In order to enhance the bronchoconstrictor response to SRS-A and to antagonize possible effects of histamine, each guinea-pig received 1.0 mg/kg of propranolol hydrochloride and 0.2 mg/kg of thenyldiamine hydrochloride intravenously 3 min before the injection of SRS-A. The dose (volume) of crude SRS-A was chosen so as to produce an optimal range of bronchoconstriction, viz. 15 to 35 mmHg increases in resistance to pulmonary inflation. Ten parts of aspirin were mixed with three parts of Na_2CO_3 in warm water. The soluble sodium salt was kept on ice and used within 4 hours. It was injected slowly intravenously 3 min before propranolol. Rapid injections occasionally produced immediate bronchospastic reactions. Because SRS-A is labile, the effects of aspirin upon SRS-A-induced bronchoconstriction were studied simultaneously in one guinea-pig medicated with aspirin and in one control guinea-pig. Percentage inhibition of SRS-A-induced bronchoconstriction was calculated from: 1 − (ratio in mmHg of increase in resistance to inflation between medicated and control guinea-pigs) × 100.

Bronchoconstriction induced by analgesics in vivo. Guinea-pigs prepared according to Konzett & Roessler (1940) were pretreated with 1.0 mg/kg of propranolol intravenously unless indicated otherwise. Analgesics were injected intravenously 3 min later. Slow intravenous injections of aspirin or meclofenamate were immediately followed by bronchoconstriction; the peak increase in resistance to pulmonary inflation was recorded as the severity of bronchoconstriction.

Bronchoconstriction in vitro. The thoracic organs of exsanguinated guinea-pigs were removed *in toto,* and the pulmonary artery and trachea were cannulated. Oxygenated Krebs-Henseleit bicarbonate buffer solution (pH 7.0, 40°C) entered the lung at 7.5 ml/min through the trachea (Luduena, Miller & Wilt, 1955) and left it through scarifications on the lung surface. The perfusion pressure in cmH_2O was monitored continuously. Sodium aspirin was injected via the pulmonary artery in Krebs-Henseleit buffer adjusted to pH 7.0, in a volume sufficient to fill the arteriovenous system of each lung-heart preparation. The peak increase in perfusion pressure after the injection of aspirin was recorded as aspirin-induced bronchoconstriction.

Since perfusion pressure in perfused guinea-pig lungs can increase spontaneously, the average rate of spontaneous increases for each minute of perfusion was obtained from ten non-treated lungs. The adjusted increase in perfusion pressure due to aspirin was calculated as $A-B$, where A = peak increase in perfusion pressure caused by aspirin, and B = average spontaneous increase in perfusion pressure at the time at which A occurred (up to 10 min after aspirin injection).

Significances of differences between the means of medicated and control groups were calculated using the *t* test for independent samples.

Drugs

The following drugs were used in this study: aspirin (Glenbrook Laboratories, 'Bayer needles'), histamine phosphate (Lilly), propranolol hydrochloride (Ayerst Laboratories), thenyldiamine hydrochloride (Sterling-Winthrop Research Institute), sodium meclofenamate (Parke-Davis & Co.), phenoxybenzamine hydrochloride (Smith, Kline & French), and atropine sulphate (Merck & Co., Inc.). Krebs Henseleit bicarbonate buffer solution (pH 7.0) contained the following chemicals (g/l): NaCl 6.19, KCl 0.353, $CaCl_2$ 0.282, KH_2PO_4 0.162, $MgSO_4$ 0.294, $NaHCO_3$ 2.10, and dextrose 1.0.

Results

SRS-A-induced bronchoconstriction

Intravenous administration of aspirin at doses ranging from 3.3 to 330 mg/kg to 300–370 g guinea-pigs resulted in 70 to 90% inhibition of SRS-A-induced bronchoconstriction (Figure 1). The ED_{50} was 1.5 mg/kg intravenously. The same doses of aspirin administered to 400 to 550 g guinea-pigs were, in general, less effective and a dose of 330 mg/kg had no significant inhibitory effect in 400 to 550 g guinea-pigs (Figure 1).

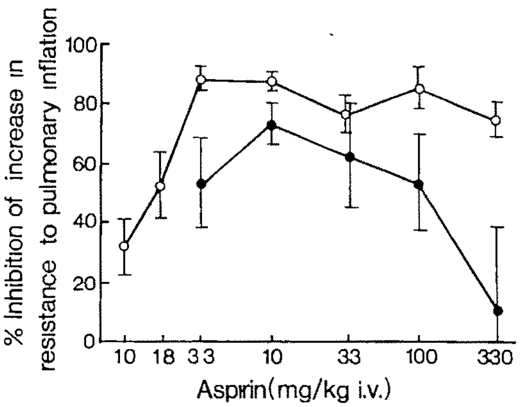

Figure 1 Inhibition of SRS-A-induced bronchoconstriction by aspirin in anaesthetized guinea-pigs: (○) 300–370 g guinea-pigs; (●) 400–550 g guinea-pigs Mean of 5–10 guinea-pigs/group are shown. Vertical lines show s.e. mean. Inhibition was significant ($P < 0.01$) at all doses, except for the 330 mg/kg dose in 400–550 g guinea-pigs ($P > 0.1$).

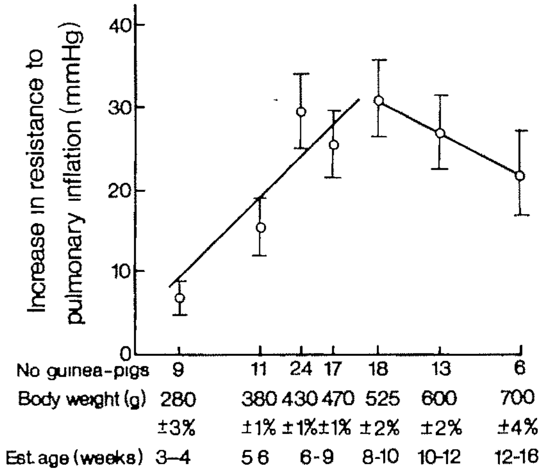

Figure 3 Effect of age upon aspirin-induced bronchoconstriction in guinea-pigs. Propranolol (1 mg/kg i.v.) was given 3 min before aspirin (330 mg/kg i.v.). All increases in resistance to inflation were significant at $P > 0.01$.

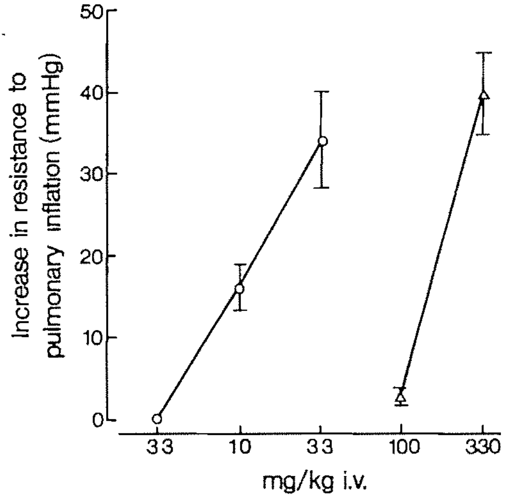

Figure 2 Bronchoconstriction in guinea-pigs following intravenous administration of aspirin (△) or meclofenamate (○). 3 min after propranolol (1 mg/kg i.v.). Means of 5–6 guinea-pigs (500–600 g each)/group are shown. Vertical lines show s.e. mean

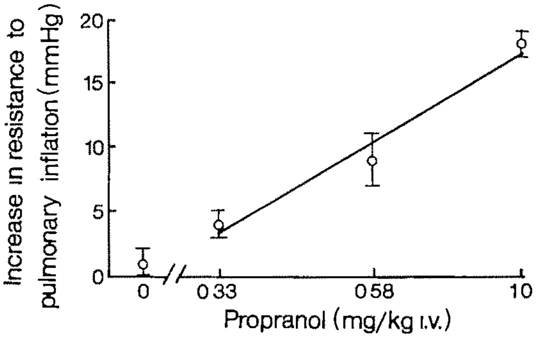

Figure 4 Relationship of β-adrenoceptor blockade to bronchoconstriction following aspirin (330 mg/kg i.v.). Means of 6 guinea-pigs (400–450 g each)/group are shown. Vertical lines show s.e. mean.

Drug-induced bronchoconstriction in vivo

When relatively high doses of aspirin or meclofenamate were administered to 500 to 600 g guinea-pigs after injections of propranolol (1 mg/kg i.v.), consistent and significant bronchoconstriction developed (Figure 2) which attained peak values in most cases within 1 to 2 minutes. The resistance to inflation increased for short periods (1–5 min) if the reaction was mild (5–10 mmHg), but greater increases in resistance to inflation lasted in most cases proportionately longer. Severe and prolonged bronchoconstriction led to death in most cases. Neither meclofenamate 33 mg/kg nor aspirin 330 mg/kg was lethal in the absence of propranolol.

The age of the guinea-pigs influenced significantly aspirin-induced bronchoconstriction which was related to age up to 8–10 weeks (expressed as body weight; Figure 3).

The role of the β-adrenergic system in aspirin-induced bronchoconstriction was studied further by administering graded intravenous doses of propranolol before the injection of aspirin. Increases in resistance to pulmonary inflation due to aspirin were related to the dose of propranolol and the resulting degree of β-adrenoceptor blockade (Figure 4).

The effect of the α-adrenoceptor system was studied by administering phenoxybenzamine at its maximal tolerated dose (50 mg/kg i.p.) 30 min before the intravenous injections of propranolol and aspirin. This dose of phenoxybenzamine blocked bronchoconstriction induced by a low dose of the α-adrenoceptor stimulant metaraminol (3.3 mg/kg i.v.) but not by a high dose (10 mg/kg). The peak increase

Table 1 Effects of atropine, phenoxybenzamine, or vagotomy upon aspirin-induced bronchoconstriction in guinea-pigs *in vivo*

Treatment before propranolol	*Body wt (g) (mean ± s.e.)*	*Peak increase in resistance to inflation after aspirin (mmHg) (mean ± s.e.)*
Atropine (1.0 mg/kg i.v.)	485±26	4±2*
Controls	480±20	29±6
Phenoxybenzamine (50 mg/kg i.p.)	428±12	12±6
Controls	411± 8	18±4
Vagotomy	496±26	19±4
Controls	490±22	19±5

Propranolol (1.0 mg/kg i.v.) was given 3 min before sodium aspirin (400 mg/kg i.v.) 10–13 guinea-pigs/group
* $P<0.01$

Table 2 Reversal of aspirin-induced bronchoconstriction in guinea-pigs by atropine

Body wt. (g) (mean ± s.e.)	*Peak increase in resistance to iflation after aspirin (mmHg†) (mean ± s.e.)*	*Injection at peak of bronchoconstriction*	*Resistance to inflation after atropine or saline (mmHg†) (mean ± s.e.)* 3 min	7 min
740±78	36±4	Saline (i.v.)	33±3	32±4
723±40	26±3	Atropine (1 mg/kg i.v.)	1±1*	0±1*

There were five guinea-pigs/group. Propranolol 1.0 mg/kg i.v. 3 min before sodium aspirin 400 mg/kg i.v.
† Above basal value
* P value of the effect of atropine vs. control <0.01.

Table 3 Effects of propranolol and/or atropine on bronchoconstriction induced in guinea-pig isolated lungs by 4% sodium aspirin intra-arterially

Group	*Drug in perfusate*	*Body wt. (g) (mean ± s.e.)*	*Adjusted peak increase in perfusion pressure after Na aspirin (cmH_2O) (mean ± s.e.)*	P *values*	
A	—	323±11	6±4		—
B	Propranolol (4 μM)	306±18	>21±4*	*vs* A	<0.05
C	Propranolol (4 μM) and atropine (2 μM)	309± 7	8±5	*vs* A	>0.1
D	—	506±15	>30±6*	*vs* A	<0.01
E	Atropine (2 μM)	492±22	10±4	*vs* D	<0.05

There were five or six guinea-pig lungs/group.
* One increase in perfusion pressure exceeded the measuring capacity of the apparatus.

in resistance to inflation in guinea-pigs pre-treated with phenoxybenzamine was slightly lower than in control guinea-pigs but the difference was not significant (*t* test; Table 1).

The participation of the parasympathetic nervous system in aspirin-induced bronchoconstriction was studied by severing both vagus nerves 15 min before each experiment and by administering atropine (1.0 mg/kg i.v.) either 3 min before the injection of propranolol, or at the peak of aspirin-induced bronchoconstriction. Aspirin-induced bronchoconstriction was largely prevented or completely reversed by atropine, but not affected by vagotomy (Tables 1 and 2). The small difference between the average peak increases in resistance to inflation in the guinea-pigs to be injected with atropine and in the control guinea-pigs (Table 2) was not statistically significant.

Drug-induced bronchoconstriction in vitro

Intra-arterial injections of 4% sodium aspirin solutions increased perfusion pressure in lungs dissected from guinea-pigs of 475 to 550 g, but not in lungs dissected from younger guinea-pigs (300–350 g) (Table 3). The increases in the lungs from older guinea-pigs were inhibited by the presence of 2 μM atropine in the perfusion fluid. If 4 μM propranolol was added to the fluid perfusing of lungs from younger guinea-pigs, intra-arterial injections of aspirin produced increases in perfusion pressure, which could be abolished by the addition of 2 μM atropine to the perfusion fluid.

Discussion

The results show the contrast between the effectiveness of aspirin against SRS-A-induced bronchoconstriction and the bronchoconstriction induced by aspirin itself. It is apparent that the declining effectiveness of high doses of aspirin against SRS-A-induced bronchoconstriction in older guinea-pigs could be attributed to its own bronchoconstrictor action. A similar reversal of the antibronchoconstrictor effect of the analgesic fenamate when administered at higher doses, has been described by Collier, James & Piper (1968).

The present test system was not suitable for studying bronchoconstriction following oral administration of aspirin or meclofenamate. However, in previous studies (unpublished data), we found that aspirin given orally counteracted SRS-A-induced bronchoconstriction in guinea-pigs with an approximate ED_{50} of 50 mg/kg (given orally). It is not known whether the described action of aspirin against SRS-A in guinea-pigs is related to the occasionally observed anti-asthmatic activity in man (Pearsons, 1963; Stresemann, 1963; Laborie, 1964; Clarke, 1969).

In vivo and *in vitro* studies suggest that aspirin-induced bronchoconstriction may be attributable to local stimulation of cholinoceptors in the presence of a reduced β-adrenergic drive in the lungs of older animals. Thus the sensitivity of β-receptors to isoproterenol is reduced in older rats (Ericsson, 1974). The incidence of aspirin intolerance is higher in middle-aged than in young asthmatics (Pearsons, 1963; Samter & Beers, 1968; Farr, 1970; Falliers, 1973; Von Maur *et al.*, 1974). The slightly decreased intensity of reactions to aspirin of older guinea-pigs (12–16 weeks) as compared to guinea-pigs of 8–10 weeks, may correspond to the decline in aspirin intolerance in patients past middle age (Pearsons, 1963).

Our finding that atropine could block and reverse aspirin-induced bronchoconstriction in guinea-pigs is in agreement with the observations of Fisherman & Cohen (1974) that atropine could block aspirin-induced increases in bleeding time and respiratory symptoms in patients sensitive to aspirin. However, our results differ from Fisherman & Cohen's (1974) in that we could not inhibit aspirin-induced bronchoconstriction by phenoxybenzamine. This failure could be due to a relatively weak blocking effect by phenoxybenzamine, as shown by its lack of activity against a higher dose of metaraminol. Hence, we cannot rule out the possibility that aspirin in a high dose has α-adrenoceptor effects, in addition to its cholinoceptor stimulation.

The present data obtained in guinea-pigs, and Fisherman & Cohen's (1974) findings in patients intolerant to aspirin suggest that the autonomic nervous system is involved in aspirin-induced bronchoconstriction, and that cholinoceptor blockade might be an effective means of preventing and/or reversing aspirin-induced asthmatic attacks.

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THE IONIZATION OF PHENOLIC AMINES, INCLUDING APOMORPHINE, DOPAMINE AND CATECHOLAMINES AND AN ASSESSMENT OF ZWITTERION CONSTANTS

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1 The dissociation constants of many phenolic amines, including benzylamines, phenethylamines, phenylethanolamines, phenylpropylamines, catecholamines, and apomorphine have been measured by potentiometric titration at 25°C. Measurements have also been made with many of their methoxy derivatives and with series of phenolic quaternary ammonium salts. Some compounds were also studied at 37°C.

2 Usually at least five titrations were made with each compound and Debye–Hückel theory was applied to convert concentrations to activities but the estimates of pK_a were not constant and found to increase with increasing concentration. The range studied was usually 5–15 mM and a least-squares line-fit, based on the empirical assumption that pK_a varies with $(\text{concentration})^{1/2}$, has been used to calculate values for 10 mM solutions and to extrapolate to infinite dilution and to 100 mM. The dependence of pK_a on concentration was much less at 37°C than at 25°C.

3 At 37°C the pK_a values of many biologically interesting compounds in the group, dopamine, noradrenaline, adrenaline and isoprenaline, coryneine (the trimethylammonium derivative of dopamine) and apomorphine are within 1 log unit of physiological pH, indicating the presence of a significant proportion of either the zwitterion or of the uncharged phenolic amine.

4 Zwitterion constants have been estimated from the pK_a values of the phenolic amines and those of their methoxy and quaternary trimethylammonium analogues. Zwitterion formation does not appear to be associated with activity at α-adrenoceptors and probably not with activity at β-receptors. The active species seems likely to contain the unionised phenolic group but at dopamine receptors this may be in the uncharged phenolic amine rather than in the phenolic ammonium salt.

Introduction

Giesecke (1973) has pointed out that the dopamine 'molecule is hidden in the apomorphine skeleton' and suggested that this might account for the central effects of apomorphine at dopamine-sensitive receptors. The structural relationship is striking and easily seen from molecular models: *N,N*-dimethyldopamine, for instance, can theoretically be derived from apomorphine simply by breaking three bonds (Figure 1).

Results in the literature, however, suggest that the ionization of apomorphine is markedly different from that of dopamine. Kolthoff (1925) obtained pK values at 15°C of 7.0 and 8.92 from the titration of apomorphine with alkali (he used indicators to measure the pH), but he considered that the first value was the basic dissociation constant K_b of the amino group and the second value that of the acidic phenolic group. Phenolic amines with pK values as close to one another as this usually dissociate in the reverse order (see below) so his results indicate pK_a values at 15°C of 7.3 and 8.9 (Perrin, 1965). At physiological pH, therefore, a considerable proportion of the apomorphine should be in the form of the phenoxide ion. However, the pK_a values of dopamine obtained by Lewis (1954) were 8.9 and 10.6, so much less should be in the form of the phenoxide ion at physiological pH. It therefore seemed necessary to check the pK_a values of these substances and to measure those of related compounds, such as *N,N*-dimethyldopamine.

In the course of the work it became apparent that there were some uncertainties about estimates of the pK_as of phenolic and catecholic amines. In the work of Lewis (1954) both spectroscopic and potentiometric methods were used at 20°C; the concentrations were 0.2 mM and 10 mM, respectively but the ionic strength

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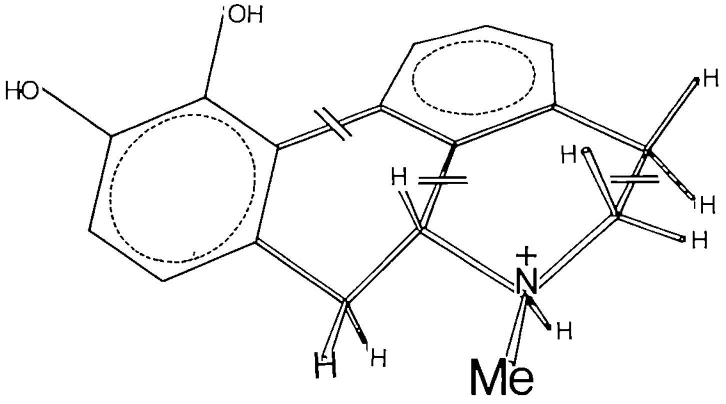


Figure 1 Structure of R-(−)-apomorphine, *N,N*-dimethyldopamine would be obtained by cutting the three bonds indicated

was kept at 0.1 M by the addition of sodium chloride. Sinistri & Villa (1962) and Villa & Sinistri (1963), working at 25°C, used a spectroscopic method with concentrations of 0.2 mM and ionic strength of 0.1 M and a potentiometric method with concentrations of 5 mM and ionic strength between 5 and 9 mM. The glass electrode measures hydrogen ion activities and they corrected their pK_a values for activity coefficients based on Debye–Hückel theory and so obtained 'thermodynamic' values which should be independent of ionic strength (Güntelberg, 1926; Albert & Sergeant, 1962; 1971). Kappe & Armstrong (1965) used a spectroscopic method at 25°C with concentrations of 0.1 to 0.2 mM and ionic strength 0.1 M and a potentiometric method at 35°C with concentrations of 20 mM and similar ionic strength. The spectroscopic method should give the dissociation of the phenolic group; the potentiometric method should give the dissociation of all ionizable groups and to simplify the calculations some workers have used values from the spectroscopic method in the results of the potentiometric titrations so that these need to be solved for only one dissociation constant. This simplification may not be justified when the conditions in the two types of experiment are different and is certainly not justified if the zwitterion $(^{-}OC_xH_yN^{+}R_2H)$ does not predominate over the form $HOC_xH_yNR_2$ (see below). It is also unnecessary if modern computing facilities are available.

The work has therefore been extended to include a systematic survey of the pK_as of phenolic and catecholic amines, analogous non-phenolic amines, and phenolic and catecholic quaternary ammonium salts (made because of their interesting nicotine-like properties; Barlow, Thompson & Scott, 1969; Barlow, Bowman, Ison & McQueen, 1974).

Methods

pK_a measurements

Accurately weighed amounts of material (10–100 mg) were dissolved in a known volume of deionized distilled water (boiled to remove dissolved gases) and the pH was measured with a Metrohm E 512 meter and EA 121 combination glass electrode following the addition of accurately measured amounts of standardized NaOH from a Metrohm E 412 Dosimat (fitted with a 4 ml burette). The titration vessel was surrounded by water circulated from a Haake model FE thermostat with a temperature control better than ±0.1°C. An interval of at least 10 min was allowed for thermal equilibration before the start of any titration and about 1 min was allowed after each addition of alkali for equilibration of the glass electrode. A slow stream of N_2 was blown through the solution, which was stirred continuously with a Teflon coated magnetic stirrer. The meter was calibrated with buffers of pH 6.99 and 9.15 at 25°C (6.97 and 9.07 at 37°C). The instrument remained stable for long periods but the calibration at pH 9 was usually checked before each titration. Only occasionally was there any detectable drift.

Most compounds were titrated in amounts of 0.1, 0.15, 0.2, 0.25 and 0.3 mmol, dissolved in 20 ml of water. The NaOH (BDH 0.1 molar 'AVS', free from carbonate) was consistently found to be 0.0995 to 0.0996 molar by titration with HCl (0.10 molar prepared from BDH 'CVS' solutions). With some compounds the concentration which could be titrated was limited by the low solubility of the product formed by loss of a proton. This applied particularly to apomorphine which could not be studied in solutions much above 1 mM (compared with 5 to 15 mM for most other compounds); the volume in these experiments was 30 ml but even with this increase the weight of material was only 6–12 mg and there must be an appreciable error associated with its measurement. For the other compounds, however, it is the ability to calibrate the meter which is the main source of error provided the compounds tested are of adequate purity. Most experiments were performed by a single operator (JA). Practice in reading the meter should reduce errors (and it is noticeable that results are often more scattered when these include those of other operators) but it seems likely that there is a systematic error of at least ±0.01 units in the pK_a values, associated with the calibration of the instrument.

Calculation of results

It is necessary to know the molecular weight of the compound, the amount taken, the initial volume in which it was dissolved (usually 20 ml), the strength of the NaOH (usually 0.0996 M), the volume added and the corresponding pH. It is also necessary to know the ionic product of water and the Debye–Hückel parameters *A* and *B* (respectively 13.997, 0.5115 and 0.3291 at 25°C and 13.590, 0.5242 and 0.3318 at 37°C; Robinson & Stokes, 1965) and to estimate the size parameter, *a*, in the Debye–Hückel expression (Albert & Sergeant, 1971, use a value of 5 Å but we have used 6.0 Å, see below).

For compounds with only one titratable proton the concentration of the substance, C, and of alkali, A, is calculated for each value of added alkali and observed pH, together with the hydrogen and hydroxyl ion concentrations. For the process

$$BH^+ \rightleftharpoons B + H^+$$

the ionization constant

$$K = \frac{[B][H^+]}{[BH^+]}$$

so

$$pK_a = pH + \log\frac{[BH^+]}{[B]}$$

For electrical neutrality of the solution when NaOH is added to a chloride salt,

$$[BH^+] + [Na^+] + [H^+] = [OH^-] + [Cl^-]$$

The concentration, C, of the salt$=[Cl^-]=[B]+[BH^+]$; the concentration of alkali $A=[Na^+]$. Hence

$$[B] = A + [H^+] - [OH^-]$$

and

$$[BH^+] = C - A - [H^+] + [OH^-]$$

The ratio $[BH^+]/[B]$ should therefore decrease as the titration proceeds and A increases and C decreases. As the glass electrode measures hydrogen ion activities, however, $[BH^+]$ should be multiplied by its activity coefficient, f, if the thermodynamic pK_a is to be obtained (the activity coefficient of the uncharged species, B, is taken as unity). From Debye–Hückel theory

$$-\log f = \frac{A[I]^{1/2}}{1 + Ba[I]^{1/2}}$$

so the sum of the concentration of ions (all univalent) was used to calculate the ionic strength, I, and hence estimate the activity coefficient. This was usually between 0.88 (for titrations with 15 mM initial concentrations) and 0.92 (with 5 mM).

Each addition of alkali and measurement of pH provides an estimate of pK_a and the mean estimate (±s.e.) was calculated for the number of additions made, excluding any values where the ratio $[BH^+]/[B]$ was >10 or <0.1.

For the phenolic quaternary ammonium salts the process is identical except that the loss of a proton leaves a zwitterion $R_3\overset{+}{N}(C_nH_m)O^-$, instead of the uncharged base, B. The activity coefficient of a zwitterion, however, is usually taken as unity so the same computer programme can be used to treat results with either type of compound.

For equilibria of the type $\overset{+}{H}BH = {}^+HB^- = B^-$ correction for activity coefficients, f, must be made to $[\overset{+}{H}BH]$ and $[B^-]$ so

$$pK_1 = pH + \log\frac{[\overset{+}{H}BH]f}{[{}^+HB^-]}$$

and

$$pK_2 = pH + \log\frac{[{}^+HB^-]}{[B^-]f}$$

The total concentration of salt, C, $=[\overset{+}{H}BH]+[{}^+HB^-]+[B^-]$ and for electrical neutrality $A+[H^+]+[\overset{+}{H}BH]=[OH^-]+[B^-]+C$ where A is the concentration of alkali.

The four equations can be reduced to

$$\frac{A+[H^+]-[OH^-]}{f[H^+]+2K_2} = \frac{fK_1C}{[H^+]^2+[H^+]K_1+fK_1K_2}$$

where $[H^+]$ and $[OH^-]$ represent ion activities. To calculate K_1 and K_2 from the experimental values of A, C and H^+ (and OH^-), some workers have inserted a value of K_1 estimated spectroscopically but objections to this have been given above. Britton (1942; see Albert & Sergeant, 1962) took pairs of experimental values and described a procedure for calculating K_1 and K_2 from each pair. Speakman (1940; see Albert & Sergeant, 1962) has shown that the equation above can be written in the form

$$X = K_1Y + K_1K_2$$

where X and Y are expressions involving C, A, H^+, OH^- and activity coefficients, and a least squares fit for all the titration values can be used to obtain the best estimates of K_1 and K_2 (from K_1K_2).

We have used Britton's method with the results arranged in pairs about the half-neutralization point (addition of 1 equivalent of alkali). A starting estimate of the pK values was needed in order to calculate the ionic strength and hence the activity coefficient and the calculations were then repeated with the calculated values of pK_a; no further repetition was usually necessary as it could be seen that the activity coefficients were only slightly altered.

With this method the observations must be made with pairs symmetrically arranged about the half-neutralization point. If the titration has been poorly planned there are obvious discrepancies between the pK estimates for the various pairs. With the line-fitting procedure only a single estimate is obtained for each pK from all the results and an answer can be obtained with poorly designed titrations where the fit involves only a small part of the titration curve. However, with observations properly spread over the whole titration there is little difference between the two methods. With either procedure there is greater uncertainty about the larger pK_a; the value of K_2 will be much smaller than that of K_1 and the line-fitting procedure may attach more weight to the first part of the titration curve.

The calculations, and subsequent ones relating to the dependence of pK on concentration, were made using programmes written in Fortran II with a PDP81 Digital Computer. Additional calculations have been made with the ICL 4/75 machine at the University of Bristol Computer Centre.

Compounds

Dr G.M. Thompson, Dr K.J. Turnbull and Mr J. Duguid prepared the samples indicated by their initials in Table 1; this also indicates the sources of samples of commercial origin. Analyses are given except when the samples were identical with those for which results have already been published (Barlow *et al.*, 1974).

Analyses are for ionized halide estimated gravimetrically, as in previous work, and melting points were recorded with a Mettler FP1 instrument and a Vitatron pen-recorder, with a rate of heating of 0.2°/minute. All the compounds which contain an asymmetric carbon atom were tested as racemates, except for phenylephrine and apomorphine.

We are most grateful to Macfarlan Smith Ltd for the gift of samples of apomorphine HCl, to Minnesota 3M Laboratories Ltd for (±)-adrenaline HCl, to May & Baker Ltd and Professor H.L. Friedman, Medical College, Wisconsin, for samples of the quaternary derivative of adrenaline.

Results

These are shown in Table 1. It was clear from experiments with phenethylamine hydrochloride that

Table 1 Analytical results are given for all the samples used unless these have already been published or the samples are of commercial origin. The range of concentrations is shown, the number of titrations (*n*), the slope (*m*) for the expression $pK = pK_0 + mc^{\frac{1}{2}}$, to which the values of pK_a were fitted by least squares, and the corresponding values of pK_a at 0, 10, and 100 mM. The symbol *S* indicates that the compound tended to come out of solution during the addition of alkali; the initials of Mr J. Duguid, Dr G.M Thompson and Dr K.J. Turnbull have been used to identify samples supplied by them.

Phenethylamines

	Ionized		*pK_a*			
m.p.	*halogen*	*0*	*10*	*100 mM*	*m*	*n*
$PhCH_2CH_2NH_2HCl$ (4 8–30.7 mM)						
218.1–219 8	22.52 (22.49)	9.43	9.74	10.41	0.098	18
at 37°C (5.0–15.1 mM)		9.32	9 46	9.77	0.045	10
(Leffler *et al.* (1951) recorded pK_a 9 83; Lewis (1954), 9.86; Tuckerman *et al.* (1959), 9.78; Kappe & Armstrong (1965), 9.88)						
$(MeO)_2C_6H_3CH_2CH_2NH_2HCl$ (4.1–15.0 mM)						
153 5–154.0	16.34 (16.29)	9.32	9.75	10.68	0.136	5
(Sinistri & Villa (1962) recorded pK_a 9.97)						
$PhCH_2CH_2NHMe$ HCl (4.7–15.1 mM)						
163.3–163.8	20 73 (20.65)	9.38	9.93	11.11	0.173	7
(Tuckerman *et al.* (1959) recorded pK_a 10.31)						

m.p.	Ionized halogen	pK_a			m	n
		0	10	100 mM		
m-MeOC$_6$H$_4$CH$_2$CH$_2$NHMe HCl (5.0–15.0 mM)						
120.5–121.2	17.58 (17.58)	9.78	9.99	10.44	0.066	5
p-MeOC$_6$H$_4$CH$_2$CH$_2$NHMe HCl (5.0–15.0 mM)						
180.8–181.7	17.64 (17.58)	9.72	10.04	10.72	0.099	5
(MeO)$_2$C$_6$H$_3$CH$_2$CH$_2$NHMe HCl (4 4–15.1 mM) *KJT*						
138.2–138.7	15.20 (15.30)	9.38	9.87	10.92	0.154	5
PhCH$_2$CH$_2$NHEt HCl (3.5–15.0 mM)						
184.5–185 2	19.17 (19.09)	9.63	10.04	10.92	0.129	7
PhCH$_2$CH$_2$NH*iso*Pr HCl (4.0–15.0 mM)						
168.5–169.2	17.75 (17.74)	9.52	10.04	11.16	0.164	6
PhCH$_2$CH$_2$NMe$_2$ HBr (5.0–15.0 mM) *GMT*						
149.3–150.0	34 78 (35.17)	8.80	9.19	10.02	0.122	5
m-MeOC$_6$H$_4$CH$_2$CH$_2$NMe$_2$ HCl (3.8–14.9 mM) *KJT*						
133.1–134.1	16.34 (16.44)	8.74	9.07	9.77	0.103	7
p-MeOC$_6$H$_4$CH$_2$CH$_2$NMe$_2$ HCl (5.0–15.0 mM) *KJT*						
173 5–175 6	16.41 (16.44)	8.93	9.24	9.90	0.097	4
(MeO)$_2$C$_6$H$_3$CH$_2$CH$_2$NMe$_2$ HCl (3.8–15.0 mM) *KJT*						
192 0–193 6	14 32 (14.43)	8.75	9.15	10.02	0.127	5
PhCH$_2$CH$_2$NEt$_2$ HBr (5.0–15.0 mM)						
107.3–107.7	31.03 (30 94)	9.35	9.79	10.74	0.139	5
Benzylamines						
PhCH$_2$NMe$_2$ HCl (5.0–15.1 mM)						
173 5–174 1	not analysed	8.40	8.80	9.68	0.128	6
PhCH$_2$NMe$_2$ HBr (5.0–15.1 mM)						
143.5–144.0	37.01 (36.97)	8.51	8.79	9.41	0.090	6
m-MeOC$_6$H$_4$CH$_2$NMe$_2$ HCl (5.0–15.0 mM)						
165.0–166 2	17.68 (17.58)	8.65	8.78	9.06	0.041	5
p-MeOC$_6$H$_4$CH$_2$NMe$_2$ HCl (5.0–15.0 mM)						
156 0–156.6	17.64 (17.58)	9.02	9.13	9.35	0.032	5
PhCH$_2$NEt$_2$ HBr (5.0–15.0 mM) *JD*						
160.8–161.4	32 78 (32 78)	8.91	9.41	10.50	0.160	5
o-MeOC$_6$H$_4$CH$_2$NEt$_2$ HBr (5.0–10.1 mM) *GMT*						
120.2–121.0	29.49 (29.14)	9.86	10.27	11.16	0.131	4
m-MeOC$_6$H$_4$CH$_2$NEt$_2$ HBr (5.0–15.0 mM) *GMT*						
145.3–146.0	29.38 (29.14)	8.95	9.26	9.94	0.099	4
p-MeOC$_6$H$_4$CH$_2$NEt$_2$ HBr (5.0–15.1 mM; *S*)						
106.5–107 2	29.17 (29.14)	9.39	9.70	10.38	0 099	5
Phenylpropylamines						
PhCH$_2$CH$_2$CH$_2$NMe$_2$ HBr (5.0–17.6 mM)						
112.5–113.2	32.78 (32.72)	9.18	9.52	10.24	0.106	9
m-MeOC$_6$H$_4$CH$_2$CH$_2$CH$_2$NMe$_2$ HCl (4 2–15.1 mM)						
131.0–131.5	15.51 (15.43)	9.23	9.54	10.21	0.098	7
PhCH$_2$CH$_2$CH$_2$NEt$_2$ HBr (3.3–8.6 mM; *S*) *GMT*						
142.0–142.7	29.44 (29.41)	9.67	10.34	11.79	0.212	5

m.p.	*Ionized halogen*	*pK_a*			*m*	*n*
		0	*10*	100 mM		
Phenylethanolamines						
$PhCHOHCH_2NH_2$ HCl (5.1–15.4 mM)						
sinters 137, 200–205	20.46 (20.42)	8.43	8.90	9.91	0.148	5
(Tuckerman *et al* (1959) recorded pK_a 8.90; Villa & Sinistri (1963), 9.03)						
$PhCHOHCH_2NH_2$ HI (5.0–15.0 mM)						
116.7–118.5	47.77 (47.87)	8.45	8.85	9.72	0.127	6
$PhCHOHCH_2NHMe$ HCl (5.0–15.0 mM)						
104.3–104.9	18.92 (18.89)	8.90	9.29	10.14	0.123	5
(Tuckerman *et al.* (1959) recorded pK_a 9.31, Villa & Sinistri (1963), 9.44)						
$PhCHOHCH_2NMe_2$ HCl (5.1–15.1 mM)						
147.0–147.6	17.60 (17.58)	8.44	8.81	9.63	0.119	6
m-$MeOC_6H_4CHOHCH_2NMe_2$ HCl (5.0–15.1 mM)						
115.5–116.1	15.43 (15.30)	8.39	8.76	9.56	0.117	5
p-$MeOC_6H_4CHOHCH_2NMe_2$ HCl (5.1–15.1 mM)						
143.5–143.9	15.34 (15.30)	8.52	8.81	9.45	0.093	5
Ketonic phenethylamines						
$PhCOCH_2NH_2$ HCl (5.0–15.1 mM)						
187.4–187.5 dec	20.73 (20.65)	7.86	8.16	8.82	0.096	5
$PhCOCH_2NMe_2$ HCl (5.0–17.5 mM)						
172.4–173.3	17.82 (17.74)	7.88	8.04	8.38	0.050	5
Phenolic quaternary ammonium salts						
(Analytical details for all the samples have already been published: Barlow *et al.*, 1969; Barlow *et al.*, 1974)						
o-$HOC_6H_4CH_2\overset{+}{N}Me_3$ I^- (4.6–15.1 mM)						
		8.20	8.46	9.02	0.082	4
m-$HOC_6H_4CH_2\overset{+}{N}Me_3$ I^- (5.0–15.1 mM)						
		8.51	8.75	9.28	0.076	10
p-$HOC_6H_4CH_2\overset{+}{N}Me_3$ I^- (5.0–15.1 mM)						
		8.50	8.58	8.77	0.027	8
m-$HOC_6H_4CH_2\overset{+}{N}Et_3$ I^- (5.0–15.0 mM)						
		8.65	8.83	9.22	0.057	5
p-$HOC_6H_4CH_2\overset{+}{N}Et_3$ I^- (5.0–15.0 mM)						
		8.44	8.72	9.34	0.090	5
o-$HOC_6H_4CH_2CH_2\overset{+}{N}Me_3$ I^- (5.0–15.0 mM)						
		8.76	9.23	10.24	0.148	4
m-$HOC_6H_4CH_2CH_2\overset{+}{N}Me_3$ I^- (4.1–15.0 mM)						
		8.84	9.15	9.84	0.100	5
p-$HOC_6H_4CH_2CH_2\overset{+}{N}Me_3$ I^- (2.5–15.0 mM)						
		8.99	9.35	10.13	0.114	6
o-$HOC_6H_4CH_2CH_2CH_2\overset{+}{N}Me_3$ I^- (4.8–15.0 mM)						
		9.22	9.58	10.34	0.112	4
m-$HOC_6H_4CH_2CH_2CH_2\overset{+}{N}Me_3$ Br^- (5.0–15.0 mM)						
		9.18	9.47	10.09	0.091	3
m-$HOC_6H_4CH_2CH_2CH_2\overset{+}{N}Me_3$ I^- (5.0–14.9 mM)						
		9.21	9.51	10.15	0.093	4
at 37° (5.0–15.0 mM)		9.18	9.37	9.76	0.058	5

m.p.	*Ionized halogen*	*pK*			*m*	*n*
		0	*10*	100 mM		
p-$HOC_6H_4CH_2CH_2CH_2\overset{+}{N}Me_3\ I^-$ (3.0–15.1 mM)						
		9.26	9.52	10.08	0.082	6
$(HO)_2C_6H_3CH_2CH_2\overset{+}{N}Me_3\ I^-$ (2.2–25.0 mM)						
		8.42	8.75	9.47	0.105	7
		10.3	12.1	?	0.6	
at 37° (5.0–15.0 mM)		8.53	8.66	8.94	0.040	5
		10.9	12.2	?	0.4	
$(HO)_2C_6H_3CH_2CH_2CH_2\overset{+}{N}Me_3\ Br^-$ (4.2–15.1 mM)						
		8.77	9.06	9.67	0.089	5
		10.2	12.3	?	0.7	
Phenolic quaternary ammonium salts· alcohols						
m-$HOC_6H_4CHOHCH_2\overset{+}{N}Me_3\ Br^-$ (5.0–15.0 mM)						
162.3–164.2	28.86 (28.93)	9.02	9.18	9.51	0.049	6
p-$HOC_6H_4CHOHCH_2\overset{+}{N}Me_3\ Br^-$ (5.0–15.0 mM)						
230.6–231.1 dec	28.95 (28.93)	9.05	9.19	9.51	0.047	5
$(HO)_2C_6H_3CHOHCH_2\overset{+}{N}Me_3\ Cl^-$ (4.7–15.0 mM)						
161.3–164.8 dec	14.41 (14.31)	8.35	8.62	9.18	0.082	6
		10.8	12.2	?	0.5	
(Sinistri & Villa (1962) recorded pK_a 8.90 for the bromide)						
Ketones						
m-$HOC_6H_4COCH_2NMe_3\ Br^-$ (5.0–15.0 mM)						
230.2–230.4 dec	29.09 (29.14)	8.26	8.45	8.88	0.062	5
p-$HOC_6H_4COCH_2NMe_3\ Br^-$ (5.0–15.0 mM)						
230.4–230.7 dec	29.09 (29.14)	7.11	7.22	7.47	0.036	5
$(HO)_2C_6H_3COCH_2NMe_3\ Cl^-$ (5.0–15.0 mM)						
231.0–231.2 dec	14.52 (14.43)	6.84	6.95	7.21	0.037	7
		11.1	11.7	12.8	0.17	
Phenolic amines: benzylamines						
m-$HOC_6H_4CH_2NMe_2$ HBr (5.0–15.0 mM) *GMT*						
134.4–134.5	34.23 (34.43)	8.15	8.42	9.00	0.086	3
		9.56	10.1	11.3	0.17	
p-$HOC_6H_4CH_2NMe_2$ HBr (5.0–15.0 mM)						
149.5–150.2	34.31 (34.43)	8.50	8.63	8.91	0.041	5
		10.1	10.4	11.0	0.10	
o-$HOC_6H_4CH_2NEt_2$ HBr (5.0–15.0 mM) *GMT*						
255.0–257.0	31.03 (30.77)	7.88	8.13	8.65	0.077	3
		10.6	11.9	14?	0.4	
m-$HOC_6H_4CH_2NEt_2$ HBr (5.0–15.0 mM) *GMT*						
131.1–131.9	30.92 (30.77)	8.30	8.62	9.32	0.102	3
		10.1	10.5	11.5	0.14	
p-$HOC_6H_4CH_2NEt_2$ HBr (5.0–15.0 mM) *GMT*						
151.7–152.3	30.48 (30.77)	8.39	8.69	9.35	0.096	3
		10.2	10.8	12.2	0.20	

	Ionized	pK_a				
m.p.	halogen	0	10	100 mM	m	n
Phenolic amines: phenethylamines						
m-$HOC_6H_4CH_2CH_2NH_2$ HBr (2.6–15.0 mM)						
115.5–116.5	36.90 (36.64)	8.58	9.07	10.12	0.153	6
		9.73	10.5	12.2	0.25	
(Kappe & Armstrong (1965) recorded pK_a 9.58, 10.5)						
p-$HOC_6H_4CH_2CH_2NH_2$ HCl (tyramine HCl, 5.0–15.0 mM)						
Koch-Light, recryst.		8.74	9.23	10.28	0.154	9
		9.91	10.6	12.0	0.20	
(Lewis (1954) recorded pK_a 9.53, 10.8; Kappe & Armstrong (1965), 9.74, 10.5)						
m-$HOC_6H_4CH_2CH_2NHMe$ HBr (5.0–15.0 mM)						
94.4–95.3	34.57 (34.43)	9.07	9.17	9.39	0.031	5
		10.4	10.7	11.5	0.11	
p-$HOC_6H_4CH_2CH_2NHMe$ HBr (5.0–15.0 mM)						
125.4–126.6	34.08 (34.43)	9.20	9.36	9.69	0.049	5
		10.5	10.9	11.6	0.11	
m-$HOC_6H_4CH_2CH_2NMe_2$ HCl (5.0–15.0 mM)						
161.6–162.1	17.66 (17.58)	8.50	8.83	9.54	0.103	5
		9.64	10.1	11.3	0.16	
p-$HOC_6H_4CH_2CH_2NMe_2$ HBr (5.0–15.0 mM)						
175.1–175.8	32.50 (32.46)	8.73	9.06	9.76	0.103	5
		9.95	10.3	11.1	0.12	
(Kappe & Armstrong (1965) recorded pK_a 9.78, 10.0)						
$(HO)_2C_6H_3CH_2CH_2NH_2$ HCl (dopamine HCl, 5.0–15.0 mM)						
242.7–243.5 dec	18.61 (18.69)	8.55	8.81	9.38	0.083	5
		9.84	10.5	12.0	0.22	
at 37°C (5.0–15.0 mM)		8.33	8.45	8.73	0.040	5
		9.61	9.74	10.0	0.042	
(Lewis (1959) recorded pK_a 8.87, 10.6 (20°C))						
6-Hydroxydopamine HCl (5.0–15.0 mM)						
Aldrich	not analysed	8.53	8.78	9.31	0.078	5
		9.88	10.3	11.2	0.14	
N-methyldopamine (Epinine) HBr (5.0–15.0 mM) *KJT*						
166.4–167.2	31.98 (32.21)	8.44	8.75	9.42	0.097	3
		10.1	10.7	12.0	0.20	
(Lewis (1954) recorded 8.90, 10.6 (20°C))						
N,N-dimethyldopamine HCl (5.0–15.2 mM) *KJT*						
123.2–125.0	16.16 (16.29)	8.51	8.71	9.14	0.063	5
		9.72	10.2	11.1	0.14	
at 37°C (5.0–15.0 mM)		8.54	8.54	8.55	0.001	5
		9.87	9.96	10.1	0.03	
Phenolic amines: phenylpropylamines						
m-$HOC_6H_4CH_2CH_2CH_2NMe_2$ HCl (2.3–14.9 mM)						
89.3–90.3	16.37 (16.44)	9.03	9.16	9.45	0.042	5
		9.87	10.3	11.4	0.15	
p-$HOC_6H_4CH_2CH_2CH_2NMe_2$ HBr (5.0–15.0 mM) *GMT*						
119.2–119.4	30.68 (30.76)	8.86	9.26	10.16	0.125	3
		9.73	10.4	11.7	0.20	
p-$HOC_6H_4CH_2CH_2CH_2NEt_2$ HBr (5.0–15.0 mM)						
152.9–153.1	28.03 (27.77)	9.08	9.47	10.29	0.121	6
		9.93	10.8	12.7	0.28	

	Ionized		pK_a			
m.p.	*halogen*	*0*	*10*	100 mM	*m*	*n*
Phenolic amines: phenylethanolamines						
m-$\mathrm{HOC_6H_4CHOHCH_2NH_2}$ HCl (Norphenylephrine, 5 1–15 1 mM)						
Aldrich	not analysed	8.34	8.65	9.31	0.097	5
		9.48	9.87	10.7	0.12	
p-$\mathrm{HOC_6H_4CHOHCH_2NH_2}$ HCl (Octopamine, 5.0–15.0 mM)						
Sigma	not analysed	8.40	8.73	9.42	0.102	6
		9.41	9.89	10.9	0.15	
(Lewis (1954) recorded pK_a 9.53, 9.70, Kappe & Armstrong (1965), 8 57, 9 66)						
m-$\mathrm{HOC_6H_4CHOHCH_2NHMe}$ HCl (Phenylephrine, 4.9–15.3 mM)						
Koch-Light	not analysed	8.53	8.84	9.50	0.096	5
		9.52	10.1	11.3	0.18	
p-$\mathrm{HOC_6H_4CHOHCH_2NHMe}$ HCl (Synephrine, 5 1–15 1 mM)						
130.0–130.2 dec	17.61 (17.41)	8.61	8.83	9.30	0.069	5
		9.70	10.0	10 7	0 10	
(Lewis (1954) recorded pK_a 9.59, 9.71; Kappe & Armstrong (1965) 9.55, 9.79)						
Noradrenaline HCl (5.0–15.0 mM)						
Aldrich	not analysed	8.39	8.53	8.85	0.046	5
		9.46	9.75	10.4	0.09	
at 37°C (5.0–15.0 mM)		8.30	8.32	8.35	0.005	5
		9.56	9.58	9.61	0.004	
(Lewis (1954) recorded pK_a 8.73, 9.78; Sinistri & Villa (1962), 8.73, 9.83; Kappe & Armstrong (1965), 8.72, 9.72)						
Adrenaline HCl (5.0–10.1 mM; *S*)						
Minnesota	not analysed	8.31	8.57	9.14	0.083	6
3M Labs		9.56	10.01	11.0	0.14	
at 37°C (5 0–15.0 mM)		8.27	8.39	8.65	0.039	5
		9.72	9.85	10.1	0.04	
(Lewis (1954) recorded pK_a 8.71, 9.90; Sinistri & Villa (1962), 8.79, 10.09; Kappe & Armstrong (1965), 8.75, 9.89)						
Isoprenaline HCl (4.9–15.1 mM)						
Sigma	not analysed	8.49	8.55	8.68	0.019	5
		9.58	10.04	11.0	0.14	
at 37°C (5.0–15.0 mM)		8.42	8.43	8 46	0.004	7
		9.70	9.86	10.2	0.05	
(Lewis (1954) recorded pK_a 8.72, 9.87; Sinistri & Villa (1962), 8.83, 10.19)						
Phenolic amines: ketones						
m-$\mathrm{HOC_6H_4COCH_2NMe_2}$ HBr (5 0–15.0 mM)						
190.8–191.5 dec	30.52 (30.72)	7.73	7.88	8.22	0.049	5
		9.20	9.36	9.70	0.050	
p-$\mathrm{HOC_6H_4COCH_2NMe_2}$ HBr (5.0–15 0 mM)						
206.1–206.7 dec	30.61 (30.72)	6.82	7.15	7.85	0.103	5
		8.86	9.20	9.94	0.108	
$\mathrm{(HO)_2C_6H_3COCH_2NMe_2}$ HCl (5.0–15.0 mM)						
210.7–211.2 dec	15.33 (15.30)	6.60	6.91	7.58	0.098	5
		8.78	9.07	9.71	0.093	
Apomorphine HCl, $\frac{1}{2}\mathrm{H_2O}$ (0.6–0.8 mM; *S*)						
Macfarlan Smith	not analysed	7.08	8.68	12.2?	0.508	5
		8.39	9.76	12.7?	0.43	
at 37°C (0.8–1.2 mM)		7.45	7.36	7.15	–0.030	5
		8.93	8.62	7.95	–0 098	

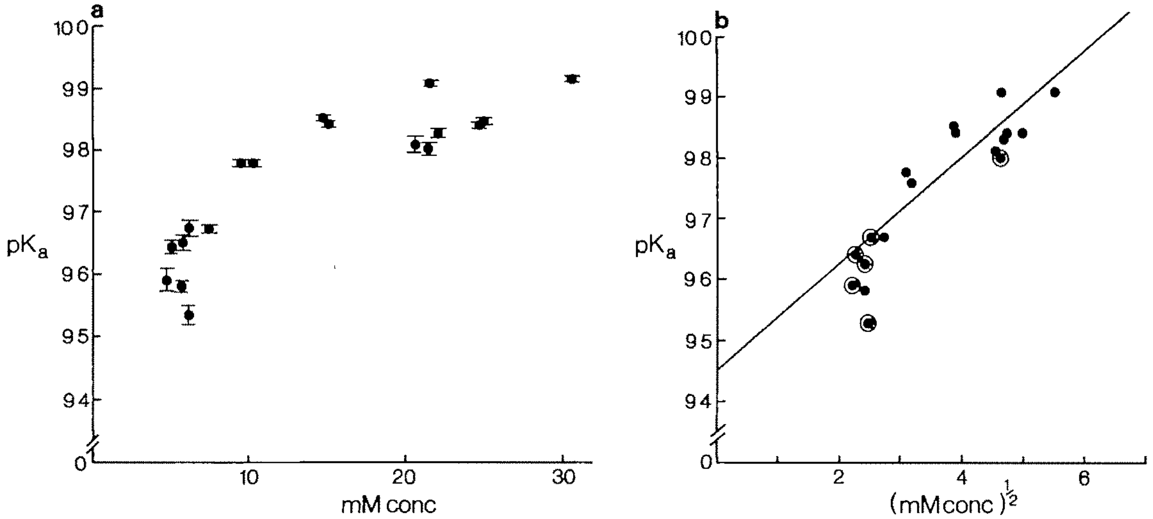


Figure 2(a) Estimates of the pK$_a$ of phenethylamine hydrochloride at 25°C plotted against the initial concentration, the vertical lines indicate the standard error. (b) Estimates plotted against the square root of the initial concentration, the straight line indicates the best fit, using least squares weighted according to the reciprocal of the variance. The large circles indicate values with standard errors greater than 0.01 log units.

the pK$_a$ values obtained were not constant but decreased with decreasing concentration (Figure 2). Other workers have not commented on any such concentration dependence, which seems to be much more marked at low concentrations. It seemed empirically that the dependence could adequately be represented by the expression $pK = pK_0 + mC^{\frac{1}{2}}$; with this the dependence would be less at higher concentrations. The results for each compound have been fitted to this relationship by least-squares, weighted according to the reciprocal of the variance associated with the estimate of pK$_a$. The concentration of the compound is reduced by the volume of the alkali added during the titration to between 0.98 to 0.87 times the initial concentration and the line-fitting procedure has been applied to the concentration in mid-titration, except in Figure 2 where the initial concentrations were used. From the values of m and pK$_0$, the pK$_a$ has been calculated for concentrations of 10 and 100 mM. The estimates at 10 mM should be the the most accurate, being in the middle of the range of concentrations tested (except for apomorphine). The extrapolated values for infinite dilution or at 100 mM are much more uncertain but the latter are of interest for comparison with some values already published.

Estimates obtained in this work are consistently lower than those previously reported but these usually lie within the range which might be expected from the observed dependence on concentration. The correction for converting 'mixed' pK$_a$ values to thermodynamic pK$_a$ values is small (log f is usually about log (0.9) = −0.05) and the use of a rather larger and more realistic size parameter ($a = 6.0$ instead of 5.0 as used by Albert & Sergeant, 1971) makes a negligible difference to the estimate of the activity coefficient at this dilution. It is clear that corrections based on Debye–Hückel theory do not yield pK$_a$ values which are actually constant but the results with low concentrations are more likely to be reliable than those with higher concentrations or at higher ionic strengths, because the corrections are smaller and the Debye–Hückel assumptions are more likely to be valid. It is unfortunate that it is values in a medium of higher ionic strength (blood) which are likely to be biologically important.

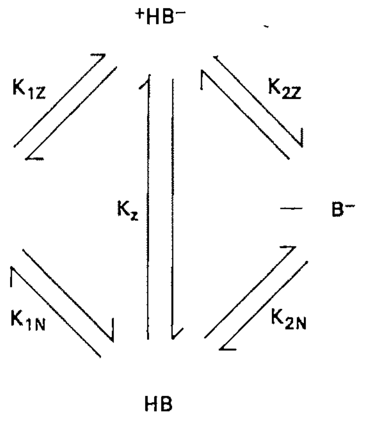
Estimates were made at 37°C with phenethylamine, dopamine, *N,N*-dimethyldopamine, noradrenaline, adrenaline, isoprenaline, *m*-hydroxyphenylpropyltrimethylammonium, coryneine (quaternary dopamine) and apomorphine and in every instance there was a reduction in pK$_a$ (by usually 0.1–0.2 log units) and in the dependence of the estimate of pK$_a$ on concentration (Table 2). This suggests that the dependence on concentration is not an experimental artefact.

The results are in reasonable agreement with those of Kolthoff (1925) for apomorphine (7.6 and 8.8 at 25° compared with 7.3 and 8.9 at 15°C) and of Lewis (1954) for dopamine (8.8 and 10.5 compared with 8.9 and 10.6). Two of the three bonds broken to convert apomorphine into dimethyldopamine (Figure 1) have important effects on pK_a; the second aromatic ring greatly enhances the acidity of the phenolic groups and the bond which makes the amino group a benzylamine derivative, rather than a phenethylamine, greatly reduces the pK_a of the amino group. Thus the striking structural resemblance between the two compounds does not really extend to their physicochemical properties (including the solubility of the species which has lost a proton).

Discussion

The results confirm the potential importance of ionization in the biological actions of compounds such as apomorphine, dopamine, and catecholamines. At receptors where there is appreciable stereospecificity there must clearly be other factors involved, because the pK_as of enantiomers are identical; it is, nevertheless, striking that all the biologically interesting compounds in Table 2 have pK_a values at 37°C which are within 1 unit of physiological pH.

The first pK_a will include the ionization which leads to the non-charged form with which the zwitterion is in equilibrium:



and it may be relevant to know the position of all the equilibria. If K_{1Z} and K_{1N} represent the dissociation constants into zwitterions and non-charged species,

Table 2 Effect of temperature on pK_a (10 mM)

	25°C		*37°C*		Δ
	pK_a	*m*	*pK_a*	*m*	
$PhCH_2CH_2NH_2$	9.74	0.094	9.46	0.045	0.28
Dopamine	8.81	0.083	8.45	0.040	0.36
	10.52	0.217	9.74	0.042	0.78
N,N-dimethyldopamine	8.71	0.063	8.54	0.001	0.17
	10.16	0.140	9.96	0.029	0.20
Noradrenaline	8.53	0.046	8.32	0.005	0.21
	9.75	0.093	9.58	0.004	0.17
Adrenaline	8.57	0.083	8.39	0.039	0.18
	10.01	0.141	9.85	0.040	0.16
Isoprenaline	8.55	0.019	8.43	0.004	0.12
	10.04	0.143	9.86	0.052	0.18
m-Hydroxyphenylpropyltrimethylammonium	9.51	0.093	9.37	0.058	0.14
Coryneine*	8.75	0.105	8.66	0.040	0.09
Apomorphine (at 1 mM)	7.59	0.508	7.42	−0.030	0.17
	8.82	0.433	8.83	−0.098	−0.01

* Trimethylammonium derivative of dopamine. Values for the dissociation of the second phenolic group have been omitted.

respectively, and K_Z represents the zwitterion equilibrium constant, $[^+HB^-]/[HB]$

$$K_1 = \frac{[^+HB^- + BH][H^+]}{[HBH^+]}$$
$$= K_{1Z} + K_{1N}$$
$$= K_{1Z}(1 + 1/K_Z)$$
$$= K_{1N}(1 + K_Z)$$

Spectroscopic methods which depend on the different u.v. absorption spectra of phenolic ($-C_6H_4OH$) and phenate ($-C_6H_4O^-$) groups should measure pK_{1Z} and can be used to estimate K_{1N} and K_Z when pK_1 has been measured by titration. Values of pK_{1Z} will be greater than pK_1 (this is apparent, for instance in the results obtained by Lewis, 1954) and the difference ($pK_{1Z} - pK_1$) is log $(1 + 1/K_Z)$, so the bigger the difference, the smaller the extent of zwitterion formation. If K_Z is large, $(1 + 1/K_Z) \rightarrow 1$ and the difference in $pK \rightarrow 0$. Unfortunately it is difficult to estimate K_Z accurately if it is large. For example when $K_Z = 5$, $\Delta pK = \log 1.2 = 0.08$; for $K_Z = 20$, $\Delta pK = \log 1.05 = 0.02$.

Alternatively it may be supposed that the value of K_{1N} will be the same as that for the corresponding methoxy compound. The value of pK_1 will be less that of pK_{1N} by log $(1 + K_Z)$ so that the greater the extent of zwitterion formation, the greater will be the difference in pK_a. Sinistri & Villa (1962) used this method to calculate the four ionization constants (K_{1Z}, K_{1N}, K_{2Z}, K_{2N}) for noradrenaline, adrenaline, isoprenaline and some related compounds. They found that their estimates of K_{1Z} obtained in this way agreed well with values obtained spectroscopically (even though there is a difference in ionic strength) and moreover the value for the quaternary trimethylammonium derivative of noradrenaline, which can exist only in the ionized form, was the same to within 0.01 log units when measured by potentiometric titration or spectrophotometrically. Their results give values of K_Z of 1.8 for noradrenaline, 4.3 for adrenaline and 4.7 for isoprenaline. From the values of pK_1 obtained potentiometrically and spectroscopically by Lewis (1954; at constant ionic strength) the values of K_Z for noradrenaline, adrenaline and isoprenaline appear to be 2.1, 2.1 and 2.4 respectively. Clearly more information is needed to see what size of error may be attached to estimates of K_Z and whether there really is a difference between the extent of zwitterion formation by noradrenaline and adrenaline.

The zwitterion constant, K_Z, can also be calculated from pK_2 if it is assumed that pK_{2N} is the same as for a substituted phenol, such as hydroxymethyl-phenol, which contains a group electronically similar to amino but which cannot acquire a positive charge in the conditions of the titration. Sprengling & Lewis (1953) obtained pK_a values at 25°C and 0.02 M ionic strength of 9.83 for *m*-methylolphenol and 9.82 for the *p*-isomer and from the collection of pK_a values compiled by Kortüm, Vogel & Andrussov (1961) it seems likely that this should be close to the value of pK_{2N}, because changes in groups separated from the benzene ring by one or more methylene groups do not markedly alter the phenolic pK_a. As

$$K_2 = \frac{[B^-][H^+]}{[^+HB^- + HB]}$$
$$= \frac{[B^-][H^+]}{[HB](1 + K_Z)}$$
$$pK_2 = pK_{2N} + \log(1 + K_Z)$$

and the difference between pK_2 and 9.8 should be log $(1 + K_Z)$.

Instead of using information from only one experimental pK_a value, either pK_1 or pK_2, it is possible to use both values because the range

$$pK_2 - pK_1 = pK_{2N} - pK_{1N} + 2\log(1 + K_Z)$$

and this might be more accurate than the other methods because the number actually calculated is bigger, so the experimental errors associated with the estimates of pK_a may be less important.

For many of the results obtained in this work it is possible to calculate K_Z by several of these methods and to compare the results obtained (Table 3). As the results for the quaternary compounds may indicate pK_{1Z}, and those for the methoxy compounds may indicate pK_{1N}, it is possible to predict the value of K_Z, for instance, for compounds which have not yet been prepared, and these values are also included.

The results suggest that the size of K_Z determines the most suitable method for estimating it. When it is large method 1 is unsuitable, as has already been indicated, and this will apply whether K_Q is used to estimate pK_{1Z} or if it is estimated spectrophotometrically. When the side chain contains strongly activating groups next to the benzene ring (carboxyl and to a lesser extent hydroxyl) method 3 is inadequate because the value of pK_{2N} is not the same as that of hydroxymethylphenol. In contrast the guessed values of pK_{Me} which it has been necessary to use in some instances are not likely to be seriously inaccurate. The effects of substituents, such as methoxyl, on pK_a are summarized in Table 4 and although they are by no means constant, they should be predictable to within about 0.1 log units.

Provided an unsuitable method has not been used, the estimates appear to fall within a 2-fold range and values of log K_Z would be consistent to within about 0.15 log units. In addition to values for noradrenaline, adrenaline and isoprenaline which can be calculated from the results of Lewis (1954) and of Sinistri & Villa

Table 3 Zwitterion constants (K_z)

These are calculated from pK_1, pK_2, pK_{Me} (for the methoxy compound) and pK_Q (for the trimethylammonium compound) using the relations:

1. $pK_Q - pK_1 = \log(1 + 1/K_Z)$
2. $pK_{Me} - pK_1 = \log(1 + K_Z)$
3. $pK_2 - pK_1 = 9.80 - pK_{Me}$
4. $\log K_Z = pK_{Me} - pK_Q$

In some instances the value of pK_{Me} has been guessed and is printed in italics. In other instances, marked 'nc', the difference between pK_Q and pK_1 is negative and a result cannot be calculated, and with some groups, notably the ketones, the values calculated by method 3 differ markedly from the rest (and sometimes cannot be calculated), indicating that the value assumed for the ionization of the substituted phenol (9.80) is incorrect. The asterisk indicates values of K_Q for the triethylammonium compound; all others are for trimethylammonium

Compound		pK_1	pK_2	pK_{Me}	pK_Q	K_Z			
						1	2	3	4
$HOC_6H_4CH_2$–									
o-	NEt_2	8.13	11.90	10 27	8.46	0 8	140	130	65
m-	NMe_2	8.42	10.10	8.78	8.75	0.8	1.3	1.1	1.1
	NEt_2	8 62	10.61	9.26	8.83*	1 6	3.4	3.7	2.6
p-	NMe_2	8.63	10 38	9.13	8.58	nc	2.2	2.5	3.5
	NEt_2	8 69	10.82	9.70	8.72*	14	10	10	9.6
$HOC_6H_4CH_2CH_2$–									
m-	NH_2	9.07	10.52	*9.80*	9.15	5 0	4.4	4.4	4.5
	NHMe	9.17	10.72	9.99	9.15	nc	5.5	6.4	6 9
	NMe_2	8.83	10.15	9 07	9.15	0.92	0 74	0.95	0.83
p-	NH_2	9.23	10.56	*9.85*	9.35	3.1	3.2	3.9	3 2
	NHMe	9.36	10.88	10.04	9.35	nc	3.8	6.7	4 9
	NMe_2	9.06	10.32	9.24	9 35	1 0	0.51	1.2	0.78
3,4-dihydroxy									
	NH_2	8.81	10.52	9.75	8.75	nc	7.7	5.8	10
	NHMe	8.75	10.69	9.87	8.75	nc	12	9.1	13
	NMe_2	8 71	10.16	9.15	8.75	10	1.7	1.5	2 5
$HOC_6H_4CH_2CH_2CH_2$–									
m-	NMe_2	9.16	10.34	9.54	9.51	0.81	1.4	1.9	1.1
p-	NMe_2	9.26	10.36	*9.55*	9.52	1.2	1.0	1.3	1 1
	NEt_2	9 47	10.80	*10.38*	9.52	8.3	7.1	7.9	7 2
$HOC_6H_4CHOHCH_2$–									
m-	NH_2	8.65	9.87	*8.85*	9.18	0.42	0.58	0.35	0.47
	NHMe	8.84	10.08	*9.24*	9.18	0.84	1.5	1.2	1.2
p-	NH_2	8.73	9.89	*8.95*	9 19	0 53	0.66	0.44	0.58
	NHMe	8.83	10 03	*9.34*	9 19	0 78	2.2	1.3	1.4
3,4-dihydroxy									
	NH_2	8.53	9.75	*8.95*	8.62	4.3	1.6	0.55	2.1
	NHMe	8.57	10.01	*9.34*	8.62	8.3	4.9	2.1	5.2
	NH*iso*Pr	8.55	10.04	*9.41*	8.62	5.9	6.2	2.6	6.2
$HOC_6H_4COCH_2$–									
m-	NMe_2	7.88	9.36	*8.00*	8.45	0.37	0.32	nc	0.35
p-	NMe_2	7 15	9.20	*8.10*	7.22	5.9	7.9	0.5	7.6
3,4-dihydroxy									
	NMe_2	6.91	9.07	*8.04*	6.95	10	12	0.6	12

(1962), it is possible from the former to obtain values for dopamine (8.3) and tyramine (1.4), which are in the same range as those obtained in this work. Values of K_Z calculated by method 4 appear to be in reasonable agreement with values measured experimentally and this method seems likely to be useful for predicting the extent of zwitterion formation in new compounds.

The results indicate that there are differences between the extent of zwitterion formation in noradrenaline, adrenaline and isoprenaline and confirm that there is a trend to increasing zwitterion formation with increasing chain length, to be seen in the results of Sinistri & Villa (1962). There is considerable zwitterion formation in dopamine and epinine but it is markedly reduced by the insertion of a further methyl group, producing *N,N*-dimethyldopamine. In contrast the proportion is high for many diethylamino compounds. In the compounds with only one methylene group and in those with two methylene groups and an alcoholic or ketonic group adjacent to the benzene ring, the *p*-isomers have bigger zwitterion constants than the *m*-isomers: in the compounds with a simple ethylene side-chain the *m*-isomers have slightly larger zwitterion constants than the *p*-isomers.

The extent of zwitterion formation in apomorphine cannot be assessed directly from this work as there are

Table 4 Effects of changes in structure on pK_a (10 mM) in amines or phenolic quaternary ammonium salts with only one ionizable group

Compound	*Group*					
	m-MeO	*p*-MeO	$3.4\ (MeO)_2$	$-CH_2-$	OH	C=O
$PhCH_2NMe_2$	−0.02	0 33		0.39		
NEt_2	−0 15	0.29		0.38		
$PhCH_2CH_2NH_2$			0 01		−0 87	−1.58
NHMe	0.06	0 11	−0 06		−0.64	
NMe_2	−0 12	0.05	−0.04	0 33	−0.38	−1 15
m-MeO					−0.31	
p-MeO					−0.43	
$PhCHOHCH_2NMe_2$	−0.05	0.00				
$PhCH_2CH_2NEt_2$				0.55		
$Ph(CH_2)_3NMe_2$	0.02					
$HOC_6H_4(CH_2)\overset{+}{N}Me_3$		*Effect of side-chain;* phenol = 9.90				
n = 1						
o-		−1.44		0.77		
m-		−1.15		0.40		
p-		−1.32		0 77		
n = 2						
o-		−0.67		0 35		
m-		−0 75		0.16	0 03	−0.70
p-		−0.55		0.17	−0.16	−1 93
3,4-dihydroxy		−1.15		0 31	−0.13	−1 80
n = 3						
o-		−0.32				
m-		−0.39				
p-		−0.38				
3,4-dihydroxy		−0.84				
$HOC_6H_4CHOHCH_2\overset{+}{N}Me_3$						
m-		−0.72				
p-		−0.72				
3,4-dihydroxy-		−1.28				
$HOC_6H_4COCH_2\overset{+}{N}Me_3$						
m-		−1.45				
p-		−2.68				
3,4-dihydroxy		−2.95				

no values for the methoxy compound or for the quaternary compound. A rough idea may however, be obtained from the difference between pK_2 and pK_1; this seems to be about 1.1 log units at 10 mM. The pK_a of *o*-hydroxydiphenyl is about 10.0 (see Kortüm *et al.*, 1961) so for the dihydroxy compound the value is likely to be about 9.6. The pK_a of benzyldimethylamine obtained in this work is 8.8 at 10 mM so $2 \log (1+K_Z)=1.1-0.8$ and $K_Z=0.4$. At 100 mM the pK_a of benzyldimethylamine is calculated to be 9.4, so the value of K_Z might be as high as 1.8, but even so it seems unlikely that the zwitterion is a highly dominant species. In the circumstances it might well be worth investigating the matter spectroscopically.

It appears that there are significant concentrations of zwitterions present in solutions of apomorphine, dopamine and catecholamines, even allowing for effects of ionic strength on the estimates of 'thermodynamic' pK_a, and it might be thought that these species carrying both negative and positive charges, might be particularly effective in interacting with the receptor. However, the chemical features which favour zwitterion formation (alkylation of the nitrogen, *p*-substitution of the nitrogen atom rather than *m*-) are certainly not those which favour activity at α-adrenoceptors and there is no obvious correlation with activity at β-adrenoceptors. Activity appears therefore to be associated with the presence of a free hydroxyl group, either in the uncharged phenolic amine, with which the zwitterion is in equilibrium, or in the phenolic ammonium salt, $HOC_xH_y\overset{+}{N}R_2H$, which is the predominant species at physiological pH. The high activity of apomorphine at dopamine receptors with its relatively low zwitterion constant suggests that for these receptors the active species might be the uncharged phenolic amine. If this is so, *N,N*-dimethyldopamine might well be more active than dopamine as it has a lower zwitterion constant.

At the nicotine-sensitive acetylcholine receptor, where the quaternary derivative of dopamine is highly active, it is possible that the situation is quite different and the phenate ion is the active species. This could be investigated by observing the effects of pH on the activity of this compound.

The effects of substituents on pK_a (Table 4) show a variety of influences some obviously resonance in origin such as the change produced by converting methylene to carbonyl. The marked effect of the β-alcoholic group has been commented on by Tuckerman, Mayer & Nachod (1959) and by Sinistri & Villa (1962) and the decline in the effect with increasing methylation of the amino group supports the idea, suggested by the former, that in addition to the inductive effect of the hydroxyl group, there is hydrogen-bonding to the amino group. The effect of the trimethylammonium group on the ionization of the phenolic group is particularly interesting because it is greatly dependent on the distance separating the groups and is probably largely a field effect. This will be affected by the ionic strength of the solution in a way not allowed for by simple Debye–Hückel theory.

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THE EFFECTS OF pH ON THE ACTIVITY OF CORYNEINE AND RELATED PHENOLIC QUATERNARY AMMONIUM SALTS ON THE FROG RECTUS PREPARATION

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1 The activity of *m*-hydroxybenzyltrimethylammonium, coryneine (3:4-dihydroxyphenethyltrimethylammonium, 'quaternary dopamine'), and *m*-hydroxyphenylpropyltrimethylammonium relative to tetramethylammonium has been measured on the frog rectus preparation (*Rana pipiens*) at pH 7 and pH 9.

2 The compounds are more active in the more acid environment indicating that ionization of the phenolic group reduces activity to between one-half and one-tenth of that of the form with the intact hydroxyl group.

3 In contrast with the situation at aminoacid receptors, there is no reason to believe that at other receptors zwitterions are likely to be more active than the uncharged forms with which they are in equilibrium.

Introduction

Because the pK_a values of many biologically interesting phenolic and catecholic amines indicate that there is significant ionization of their hydroxyl groups at physiological pH (Armstrong & Barlow, 1976), it is desirable to know whether it is the phenate or phenolic form which is the more active. This paper describes an attempt to investigate the problem by observing the effects of changing pH on the activity of some phenolic quaternary ammonium salts on the frog isolated rectus preparation, relative to the activity of tetramethylammonium.

Responses can be obtained with the frog rectus muscle over a considerable range of pH. Kalow (1954) obtained results with pH values between 6.7 and 8.7 and Hamilton (1963) with values between 7.04 and 8.86. With phenolic quaternary ammonium salts only the ionization of the phenolic group will be affected by changes in pH and with two of the compounds tested, *m*-hydroxybenzyltrimethylammonium and coryneine (3:4-dihydroxyphenethyltrimethylammonium; the quaternary derivative of dopamine), the pK_a at 25°C was the same, 8.75, and such that a change from pH 9 to pH 7 should alter the ratio of phenate to phenolic hydroxyl from about 2:1 to about 1:50 in the more acid environment. If the ionized phenate is the more active, then the activity relative to a substance such as tetramethylammonium, whose ionization will be unaffected by changes in pH, should be very much less at pH 7 than at pH 9. The third substance tested, *m*-hydroxyphenylpropyltrimethylammonium, had a pK_a of 9.51 at 25°C in the conditions described by Armstrong & Barlow (1976; the values are for 10 mM solutions and are not independent of concentration even though corrections for activity coefficients have been applied).

Methods

The rectus abdominis muscle from *Rana pipiens* was set up as described by Edinburgh Staff (1974) at room temperature (16–18°C) and with the contractions recorded isotonically. The two preparations obtained from each frog were set up, one at pH 7 and the other at pH 9, in aerated frog-Ringer solution containing (mM): NaCl 115, KCl 2, $CaCl_2$ 1.8, tris-(hydroxymethyl)aminomethane 10, glucose 11 and HCl either 9 mM or 0.8 mM (the exact concentration depended on any adjustments necessary to obtain the desired pH, which was measured with a glass electrode and estimated to be correct to ±0.05 pH units).

Drug solutions were made up in a 10 ml stoppered measure, poured onto the preparation and allowed to act for 5 min, and there was an interval of 16 min between doses. In each comparison two concentrations of test drug and of tetramethylammonium were used which produced large and small responses and these were given in such a way that alternate large and small responses were obtained. Usually each concentration of each compound was tested only twice in all; possible advantages to be expected from testing them more often seemed to be outweighed by likely changes in the sensitivity of the preparation during the additional time required (it took over 2 h to complete a single comparison as described above). It seemed preferable to compare the activity relative to tetramethylammonium on pairs of muscles, each kept at a particular pH, rather than to attempt to compare the relative activity on the same preparation with the pH altered, because Hamilton (1963) had found that the result was affected by the order in which the alteration was made (i.e. whether the change was from the more acid pH to the more alkaline or *vice versa*).

The samples of *m*-hydroxybenzyltrimethylammonium iodide, coryneine (3:4-dihydroxyphenethyltrimethylammonium iodide), and *m*-hydroxyphenylpropyltrimethylammonium iodide were those used by Armstrong & Barlow (1976). Fresh dilutions of coryneine were made for each experiment because dilute solutions decomposed appreciably in 24 hours.

Results

The results are summarized in Table 1, which shows the mean estimates at the two pH values of the equipotent molar ratios for the compounds relative to tetramethylammonium (i.e. the number of molecules of the compound needed to produce the same effect as one molecule of tetramethylammonium). The ratio of these means gives an estimate of the effect of pH on activity. Alternatively a ratio can be calculated for the results obtained at the two pHs with each pair of preparations and the mean ratio is included in the table with the standard error and number of tests. The mean ratio and the ratio of the means are in close agreement.

It is clear that the phenolic form is more active than the phenate but the latter is not completely inactive. If the ratio of the activity at pH 7 to that at pH 9 is R, the proportion of unionized hydroxyl is U_7 at pH 7 and U_9 at pH 9, and if the activity of the ionized phenate relative to the unionized hydroxyl form is X,

$$R=\frac{U_7+(1-U_7)X}{U_9+(1-U_9)X}$$

$$\text{and } X=\frac{U_7-RU_9}{(R-1+U_7-RU_9)}$$

Values of U_7 and U_9 calculated from the dissociation constants determined at low ionic strength and at 25°C, and the corresponding values of X are given in Table 1. At the temperature of the assays and the ionic strength of the frog-Ringer the pK_a values of all the compounds tested will be greater than those determined by potentiometric titration, perhaps by as much as 0.2 units (Armstrong & Barlow, 1976). The

Table 1 Mean estimates at two pH values of equipotent molar ratios (e p m r) of compounds used, relative to tetramethylammonium

Compound	*Mean e.p.m.r.*		*Mean ratio*
	pH 7	*pH 9*	
m-Hydroxybenzyltrimethylammonium	1.78 ± 0.04 (5)	2.67 ± 0.11 (5)	1.51 ± 0.10 (5)
Ratio of means	1.50		
Fraction unionized	0.982 (0.989)	0.36 (0.47)	
Ratio (*X*) of activity of phenate to phenolic:	0.47 (0.36)		
Coryneine	0.0380 ± 0.0030 (6)	0.0722 ± 0.0048 (6)	1.95 ± 0.18 (6)
Ratio of means	1.89		
Fraction unionized	0 982 (0.989)	0.36 (0.47)	
Ratio (*X*) of activity of phenate to phenolic:	0.25 (0.10)		
m-Hydroxyphenylpropyltrimethylammonium	0.00757 ± 0.00092 (5)	0 00870 ± 0.00068 (5)	1.19 ± 0.12 (5)
Ratio of means	1.15		
Fraction unionized	0.997 (0.998)	0.76 (0.84)	
Ratio (*X*) of activity of phenate to phenolic:	0.45 (0.18)		

The equipotent molar ratios (e.p.m.r.) are relative to tetramethylammonium and the results confirm the very high activity of *m*-hydroxyphenylpropyltrimethylammonium observed by Barlow, Thompson & Scott (1969). The mean ratio is the mean of the ratios of the activity (relative to tetramethylammonium) at pH 7 to that at pH 9 for each pair of preparations, the ratio of the means is calculated from the mean values of e.p.m.r. at the two pHs. The fraction unionized refers to the phenolic group, the quaternary trimethylammonium group remains fully ionized The values for the fraction unionized and the ratio (*X*) shown in parentheses have been calculated from values of pK which are bigger by 0.2 units from those obtained by potentiometric titration.

effect of this increase in the pK_a values is that the change in ionization produced by the change in pH is reduced and X, the ratio of the activities of the unionized and ionized forms, is increased. The recalculated values are shown in parentheses in the table. Because of the errors attached to the values of R as well as to U_7 and U_9, it is difficult to obtain a precise estimate of the ratio, X, of the activities of the two forms, particularly for *m*-hydroxyphenylpropyltrimethylammonium where the effect of the pH change on ionization is small and R is close to unity. However, it seems that the presence of the negative charge lowers the activity to between one-half to one-tenth of that of the phenolic compound and has a bigger lowering effect on coryneine (with two phenolic groups) than on the other two compounds.

Discussion

Although these results only apply to phenolic quaternary ammonium salts acting at nicotine-sensitive receptors, they indicate differences from the other common class of zwitterions, amino acids. Zwitterion constants for amino acids are high (see, for instance, Albert & Serjeant, 1962) and the charged nature of the species is considered to be important for actions at amino acid receptors. It is therefore extremely interesting that for highly active phenolic compounds at nicotine-sensitive receptors the activity is associated with the free hydroxyl group rather than charged phenate. The same is true for blocking activity at these receptors by (+)-tubocurarine (Kalow, 1954) and seems likely to be true for actions of phenolic and catecholic amines at adrenoceptors (Armstrong & Barlow, 1976).

In these experiments it was noted that bigger concentrations of tetramethylammonium were needed to produce responses in the more acid environment. This could indicate suppression of ionization of negatively charged groups within the receptor with which the quaternary nitrogen atoms of the compounds interact but this is not the only possible explanation.

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CALCIUM DEPLETION OF SYNAPTOSOMES AFTER MORPHINE TREATMENT

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1 It was confirmed that morphine administration *in vivo* produced a selective decrease in the calcium content of synaptosomal fractions prepared from rat cerebral cortices. This effect was prevented by naloxone.

2 After morphine or naloxone, there were no changes in the sodium, potassium and magnesium contents of any of the seven subcellular fractions tested.

3 Since the selective calcium loss was found to occur from fractions similar to those reported to exhibit opiate receptor binding, it is concluded that calcium may play a role in the action of narcotic agonist drugs.

Introduction

Much evidence points to the involvement of several contributory factors in the phenomena of tolerance to and dependence on opiate drugs. Previous studies on the role of calcium in the action of opiates (Elliott, Kokka & Way, 1963; Kakunaga, Kaneto & Hano, 1966) have been confirmed and extended in recent work from this laboratory. Calcium levels in brain decrease after opiate agonist treatment; this effect is stereospecific and can be blocked by naloxone which in contrast, has no effect on reserpine-induced depletion of brain calcium (Ross, Medina & Cardenas, 1974; Cardenas & Ross, 1975; Ross, 1975a). Tolerance develops to calcium depletion by morphine and can be prevented by cycloheximide (Ross & Lynn, 1975; Ross, 1975b). It seemed important, therefore, to define the subcellular locus of the opiate-induced calcium depletion and at the same time to study the effect of morphine on other cations in subcellular fractions from brain.

Methods

Administration of drugs

All drugs were administered by the intraperitoneal route with control animals receiving equivalent volumes of 0.9% w/v NaCl solution (saline). Morphine was administered as the sulphate salt (25 mg/kg) and animals killed 30 min later. Naloxone hydrochloride (1 mg/kg) was administered either alone (animals killed after 45 min) or 15 min before administration of morphine. No significant differences were observed for any of the cations after naloxone treatment for 15 or 45 min, compared to saline controls.

Preparation of subcellular fractions

Fractions were prepared from brains of male Sprague-Dawley rats (175–200 g) according to the procedure outlined by Gurd, Jones, Mahler & Moore (1974), with the following modifications. Saline control or drug-treated animals were killed by decapitation at the times given in the tables. The whole brains were immediately removed, cortices dissected free and immersed in ice cold saline to remove traces of blood. A 10% homogenate was prepared in ice cold 0.32 M sucrose with a Teflon-glass homogenizer, then pelleted at 1000 *g* for 10 minutes. The resulting pellet was washed once with sucrose and pelleted a second time. The resulting pellet constituted P_1 and was saved for analysis of protein and ions. The supernatants from both washes were combined and centrifuged at 17,500 *g* for 20 min to produce the 'crude' mitochondrial pellet containing synaptosomes (P_2). The crude P_2 pellet was washed twice, resuspending each time in 0.32 M sucrose and the combined supernatants centrifuged at 100,000 *g* for 60 min to produce the microsomal pellet (P_3) and supernatant (S).

The washed mitochondrial pellet (P_2) was resuspended in 0.32 M sucrose and floated over a two gradient suspension consisting of 7.5% Ficoll in 0.32 M sucrose upper phase and 13% Ficoll in 0.32 M sucrose lower phase. This suspension was then centrifuged at 63,500 *g* for 90 minutes. The material sedimenting at each of the three interphases was collected as myelin (Myl, 0.32 M sucrose – 7.5% Ficoll), synaptosome (Syn, 7.5%–13% Ficoll) and mitochondria (Mit, 13% Ficoll). Each of the three fractions was carefully removed with a Pasteur pipette, diluted with equal volumes of ice cold 0.32 M sucrose and pelleted at 100,000 *g* for 30 minutes. The resulting myelin, synaptosomal and mitochondrial pellets were resuspended in glass distilled deionized water and thoroughly mixed by sucking up and down in a syringe equipped with a No. 14 gauge needle. After standing at 0–4°C for 15 min, the samples were pelleted at 100,000 *g* for 30 minutes. This process was repeated a second time after which aliquots of the resulting particulates were removed for ion and protein analysis. The second wash was routinely included after a washing curve determined that no further decrease in pellet content occurred for all four ions after the second wash.

Preparation of tissue samples for cation analysis

The sodium, potassium, magnesium and calcium contents were estimated for nuclear (P_1), crude microsomal (P_3), soluble (S_3), myelin (Myl), synaptosomal particulate (Syn) and mitochondrial (Mit) and mitochondrial lysate (Sm). Suitable portions of primary fractions were assayed for ion content by methods previously outlined by Hanig, Tachiki & Aprison (1972) and Cardenas & Ross (1975). Samples were removed and placed in pre-weighed disposable test tubes (Corning disPo, 16 x 100 mm culture tubes) together with 200 µl of concentrated HNO_3 (analytical grade) and the entire contents evaporated to a dry white ash over a hot plate. Incomplete ashing, evidenced by dark brown flecks of tissue, was treated with a second 200 µl volume of acid and the ashing procedure repeated. The residue was allowed to cool to room temperature then resuspended in a solution of 0.5 ml of 0.1 N HCl + 4.5 ml of 1% lanthanum oxide (in 0.1 N HCl). The solutions were then read against standard curves for the appropriate ion.

Analysis of cations

The concentrations of sodium, potassium, magnesium and calcium were determined with the aid of a Perkin-Elmer Atomic Absorption Unit Model 403. The following wave lengths and slit settings were recorded for sodium (295 nm) (4), potassium (383 nm) (4), magnesium (284 nm) (4) and calcium (211 nm) (4). The remainder of the instrument was preset in accordance with the procedure outlined in the Perkin-Elmer Analytical Method Manual, 1973. In all determinations of calcium, proper amounts of lanthanum were included to reduce phosphate interference (Hanig & Aprison, 1967). Appropriate blanks for reagents, sucrose and Ficoll-sucrose solutions were carried throughout the procedure and all samples were multiple blank corrected before calculating final concentrations.

Analysis of protein

Protein content was determined for each particulate and soluble fraction by an automated version of the method of Lowry, Rosebrough, Farr & Randall (1951).

Reagents

Drugs and chemicals used in this study and their sources are as follows: morphine sulphate (Eli Lilly Laboratories, Indianapolis, Indiana), naloxone hydrochloride (Endo Laboratories, Garden City, New York), sucrose (Grade 1) and Ficoll (Sigma Chemical Company, St. Louis, Mo.). Lanthanum and calcium standards were obtained from Research Chemical Corporation (Sun Valley, Calif.) and Fischer Scientific Company (Fairlawn, New Jersey). Sodium and potassium were obtained as their chloride salts from Mallinkrodt Chemical Works (St. Louis, Mo.). Unless otherwise specified, all reagents used were analytical grade.

Statistics

Group and paired comparisons were made with Student's *t*-test as outlined by Snedecor & Cochran (1969).

Results

Effects of morphine and naloxone on subcellular distribution of sodium and potassium

The effects of morphine sulphate (25 mg/kg) and naloxone hydrochloride (1 mg/kg) on sodium and potassium contents in subcellular fractions of brain tissue are outlined in Tables 1 and 2. Sodium and potassium were found predominantly in the soluble fractions (S + Sm) with 73.8% of the total content as sodium and 79.3% of the total as potassium. In the particulate fractions (P_1, P_3, Myl, Syn, Mit) sodium represented 45.9% of the total monovalent ion content with potassium representing 54.1% of the total.

Morphine treatment alone or in combination produced no significant changes in sodium or potassium content in any subcellular fraction. Treatment with naloxone alone also failed to produce any significant alteration of either ion.

Effects of opiate treatment on subcellular distribution of magnesium and calcium

In contrast to subcellular localization of monovalent ions, calcium and magnesium were found predominantly in the particulate fractions which contain 76.4% of the magnesium and 73.8% of the calcium. Magnesium was the predominant cation representing 73% of the total particulate fraction.

Morphine, alone or in combination with naloxone, had no significant effect on subcellular distribution of magnesium (Table 3). In contrast, acute morphine treatment revealed a highly significant calcium depletion (73%) in the synaptosomal particulate and to a lesser extent in the myelin fraction (18%) (Table 4). No significant effects were observed in any of the other subcellular fractions. Naloxone alone did not alter the soluble particulate ratios of calcium but when administered before morphine effectively prevented the depletion of calcium from synaptosomal particulates.

Table 1 Effect of opiate ligands on subcellular distribution of sodium from rat cortex

	Sodium (µmol/g) (mean ± s.e. mean)						
	P_1	P_3	*S*	*Myl*	*Syn*	*Mit*	*Sm*
Control	1.60 ±0.11	8.27 ±0.28	37 6 ± 0.79	0.163 ±0.011	1 70 ±0.01	2.65 ±0 13	2 82 ±0.24
Morphine 25 mg/kg (30 min)	1.34 ±0.10	7.51 ±0.31	39.99 ± 0.69	0.136 ±0.008	1.52 ±0.18	2.68 ±0.07	3.06 ±0.07
Naloxone 1 mg/kg (15, 45 min)	1.40 ±0 05	7.66 ±0.32	40.48 ± 0.69	0 178 ±0.015	1.36 ±0 07	2 98 ±0.09	2.78 ±0.20
Naloxone+ morphine	1.41 ±0.01	7.82 ±0.80	40 02 ± 0.69	0.155 ±0.009	1.44 ±0.50	3.02 ±0.09	2.84 ±0.34

Ion values for pellets and soluble fractions are expressed as µmol per g wet wt. of pellet or equivalent wet wt of tissue for 500 µl of soluble fractions. Values represent the means ± s.e. mean for $n=8$–10 analyses. Each analysis was performed on a sample of brain tissue represented by two cortices.

Table 2 Effect of opiate ligands on subcellular distribution of potassium from rat cortex

	Potassium (µmol/g) (mean ± s.e. mean)						
	P_1	P_3	*S*	*Myl*	*Syn*	*Mit*	*Sm*
Control	4.47 ±0.63	11.02 ± 0.28	59.66 ± 4.60	0.251 ±0.013	0.30 ±0.01	0.89 ±0.04	5.23 ±0 53
Morphine 25 mg/kg (30 min)	4.43 ±0.10	10.06 ± 0.92	55.20 ± 2.06	0.230 ±0.015	0.26 ±0 00	0.87 ±0 04	4 94 ±0.31
Naloxone 1 mg/kg (15, 45 min)	4.43 ±0.15	10.14 ± 0.64	57.02 ± 0.88	0.234 ±0.017	0.29 ±0.03	1.01 ±0.04	4.84 ±0.30
Naloxone+ morphine	4.66 0.12	9.83 ±0 53	54.74 ± 0.88	0.248 ±0.013	0.28 ±0.02	1.01 ±0.11	4.41 ±0.06

Ion values for pellets and soluble fractions are expressed as µmol per g wet wt. of pellet or equivalent wet wt. of tissue for 500 µl of soluble fractions. Values represent the means ± s.e. mean for $n=8$–10 analyses. Each analysis was performed on a sample of brain tissue represented by two cortices.

Cation content in pellet and supernatant after morphine treatment

To determine if a redistribution of cations had occurred during the fractionation procedure, 1.0 ml of the 10% homogenate from control and drug-treated animals was centrifuged at 100,000 *g* for 30 min (Table 5). The results for Na^+, K^+ and Mg^{2+} agreed well with the contents for each of these elements in the sum of the particulate fractions and also for the sum of the soluble fractions. For calcium, the 100,000 *g* pellet content was lower than the sum of the individual particulate fractions. This discrepancy did not appear to be compensated for by a difference between the sum of the soluble fractions and the single supernatant.

Morphine treatment did not affect the Na^+, K^+ or Mg^{2+} content of the pellet but the calcium content was significantly reduced (34.5%). This net loss of calcium (0.39 μmol/g) agrees well with the net loss from the sum of the individual particulate fractions (0.31 μmol/g).

Table 3 Effect of opiate ligands on subcellular distribution of magnesium from rat cortex

	Magnesium (μmol/g) (mean ± s.e. mean)						
	P_1	P_3	*S*	*Myl*	*Syn*	*Mit*	*Sm*
Control	0.71 ±0.02	1.78 ±0.11	0.78 ±0.05	0.52 ±0.02	0.40 ±0.02	0.566 ±0.015	0.44 ±0.02
Morphine 25 mg/kg (30 min)	0.66 ±0.02	1.86 ±0.47	0.838 ±0.01	0.63 ±0.01	0.38 ±0.01	0.633 ±0.029	0.50 ±0.06
Naloxone 1 mg/kg (15, 45 min)	0.70 ±0.02	1.76 ±0.04	0.83 ±0.01	0.44 ±0.02	0.45 ±0.02	0.667 ±0.017	0.46 ±0.02
Naloxone+ morphine	0.70 ±0.02	1.83 ±0.11	0.85 ±0.01	0.48 ±0.03	0.40 ±0.03	0.634 ±0.037	0.46 ±0.04

Ion values for pellets and soluble fractions are expressed as μmol per g wet wt. of pellet or equivalent wet wt. of tissue for 500 μl of soluble fractions. Values represent the means ± s.e. mean for $n = 8–10$ analyses. Each analysis was performed on a sample of brain tissue represented by two cortices.

Table 4 Effect of opiate ligands on subcellular distribution of calcium from rat cortex

	Calcium (μmol/g) (mean ± s.e. mean)						
	P_1	P_3	*S*	*Myl*	*Syn*	*Mit*	*Sm*
Control	0.29 ±0.01	0.46 ±0.02	0.13 ±0.09	0.05 ±0.01	0.32 ±0.01	0.27 ±0.01	0.24 ±0.03
Morphine 25 mg/kg (30 min)	0.27 ±0.03	0.45 ±0.02	0.13 ±0.01	0.04 ±0.01	0.09 ±0.01	0.26 ±0.01	0.21 ±0.02
Naloxone 1 mg/kg (15, 45 min)	0.28 ±0.02	0.39 ±0.02	0.15 ±0.01	0.05 ±0.01	0.31 ±0.01	0.30 ±0.01	0.22 ±0.05
Naloxone+ morphine	0.32 ±0.01	0.42 ±0.03	0.14 ±0.01	0.05 ±0.02	0.34 ±0.02	0.31 ±0.01	0.21 ±0.02

Ion values for pellets and soluble fractions are expressed as μmol per g wet wt. of pellet or equivalent wet wt. of tissue for 500 μl of soluble fractions. Values represent the means ± s.e. mean for $n = 8–10$ analyses. Each analysis was performed on a sample of brain tissue represented by two cortices.

Discussion

The effects of morphine and naloxone, alone and in combination, on cation contents in subcellular fractions have been studied. The measurements of cation distribution and protein content in subcellular fractions of brain tissue closely parallel those values previously reported by Hanig, Tachiki & Aprison (1972) with one exception. The difference between Syn + Myl calcium content and the M_2 fraction reported by Hanig *et al.* (1972) may be attributed to the techniques employed to fractionate the tissue. As outlined by Whittaker (1969) and Barondes (1974) use of Ficoll-sucrose gradients preserves more of the morphology and functionality of nerve endings, protecting them from dehydration and increasing their sensitivity to osmotic shock. It may be expected then that cation contents of fractions prepared in this manner would reflect a more accurate picture of *in vivo* contents. The 100,000 *g* pellet was not prepared over a Ficoll-sucrose gradient but pelleted from a solution of 0.32 M sucrose.

Morphine treatment produced a depletion of calcium content principally in the synaptosomal fraction. The loss of calcium from individual particulate fractions, as well as the 100,000 *g* pellet, agree with our earlier reported loss of calcium (Cardenas & Ross, 1975). Naloxone effectively prevented this depletion while producing no effects on its own action.

The lack of effects of morphine or naloxone on sodium content in any of the subcellular fractions appear in disagreement with *in vitro* models of the opiate receptor recently proposed by Pert & Snyder (1974) and Simon, Hiller, Groth & Edelman (1975). Data derived from *in vitro* binding experiments suggest that sodium acts to reduce binding of opiate agonists and increase binding of opiate antagonists. If sodium ions do, in fact, regulate distinct forms of the opiate receptor, this would imply that administration of opiate agonists *in vivo* could alter the sodium content in such a manner as to shift the receptor conformation from one form to another. However, neither morphine alone nor in combination produced any significant changes in sodium levels.

Our data would suggest that the model suggested by Pert & Snyder (1974) and Simon *et al.* (1975) be viewed in a different perspective. Previous investigations (Stahl & Swanson, 1969; 1971; Swanson, Anderson & Stahl, 1974; Yoshida & Ichida, 1974) have adequately demonstrated that 100 mM Na^+ produces decreased ^{45}Ca uptake and binding in synaptosomes and a loss of ^{45}Ca bound to synaptic membranes. From this information, together with the data presented in the present paper, we would suggest that morphine action induces a Ca^{2+} dissociated membrane state (analogous to agonist binding in absence of sodium). Naloxone binding could occur to the resting state of the membrane (Ca^{2+}-associated state, uninfluenced by Na^+) (Cardenas & Ross, 1975) or in the calcium-depleted state (analogous to the presence of sodium) causing reversal (Ross, 1975a; 1976) of the calcium depletion.

The results presented in this paper confirm our earlier observation that morphine induces a loss of calcium from brain tissue, observed as a selective reduction in the calcium content of synaptosomal particulate fractions prepared from rat cerebral cortices. These findings support our working hypothesis that calcium may play a vital role in

Table 5 Cations in pellet and supernatant from homogenates of control and treated brains

	Cation content (μmol/g wet tissue)					
	Control		*Treated**		*% Change*	
Cation	*Pellet*	*Supernatant*	*Pellet*	*Supernatant*	*Pellet*	*Supernatant*
Sodium	14.6 ± 0.3	42.3 ± 0.5	13.2 ± 0 9	42.7 ± 0.4	− 1.3 9.3%†	+0.4
Potassium	27.3 ± 0.1	61 4 ± 0.1	26.6 ± 0.1	61.4 ± 0.1	− 0.67	—
Calcium	1.13 ± 0.06	0 42 ± 0.02	0.74 ± 0.01	0.42 ± 0.01	− 0.39 35.5%††	—
Magnesium	4.71 ± 0.23	1.12 ± 0.09	4.62 ± 0.22	1.10 ± 0.06	− 0.09	−0 02

*Treated animals received morphine (25 mg/kg; 30 min). Naloxone pretreatment or naloxone alone did not produce changes significantly different from controls.

† Not significantly different from controls, †† Significantly different $P < 0.01$.

mechanisms of action of morphine-like drugs. In this connection, it is interesting to note that the subcellular loss of calcium occurs with a distribution similar to opiate receptor binding, which was recently reported by Pert, Snowman & Snyder (1974).

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EFFECT OF IONIZING RADIATION ON PROSTAGLANDIN-LIKE ACTIVITY IN TISSUES

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1 One to 7 days after whole body exposure of mice to a single dose of 700 R of x-rays, little or no change was detected in prostaglandin-like activity in the brain, blood and seminal vesicles. Slight increases in intestinal and renal tissue were not significant. In the lung, mean activity rose from 62 ng/g to a transient peak of 145 ng/g wet weight on the fourth day ($P < 0.05$). In the spleen, mean levels rose steadily from 13.2 ng/g to 259 ng/g on the fourth day ($P < 0.01$), and were still 184.4 ng/g on the seventh day.

2 Prostaglandin-like activity was measured 4 days after single doses of 200–700 R. In the lung, a significant rise was produced by 600 and 700 R, and in the spleen by 200–700 R.

3 Thin layer chromatography showed that part of the prostaglandin-like activity in spleen extracts had an R_F similar to that of [^{3}H]-prostaglandin E_1, and part to that of [^{3}H]-prostaglandin $F_{2\alpha}$.

4 Splenic tissue from mice exposed to 700 R four days earlier, inactivated prostaglandin E_1 less potently than did tissue from non-irradiated mice.

Introduction

Prostaglandin levels in tissues and body fluids are affected by a large number of physical, chemical, hormonal, immunological, nervous and other endogenous and exogenous factors (Horton, 1972; Piper, 1973). The present paper suggests that ionizing radiation produces extensive changes in prostaglandin levels of several tissues of the mammalian body. The numerous biochemical changes induced in tissues by ionizing radiation have been extensively studied (Altman, Gerber & Okada, 1970; Berdjis, 1971). Most tissue constituents are affected, particularly in tissues whose radiosensitivity is high. In such tissues radiation acts on the enzyme systems responsible for DNA and RNA synthesis and degradation, protein and lipid turnover, oxidative phosphorylation in mitochondria and nuclei, glycolysis, and other cell functions; on water and electrolyte content; on histamine, 5-hydroxytryptamine, catecholamine, and acetylcholine levels. Changes in tissue constituents with potent pharmacological actions may obviously play a special role in the development of radiation sickness.

Methods

Male Balb/c strain or crossed strain C57 × Balb/c or NZB × Balb/c mice aged 3–7 months and weighing 25–40 g were exposed to 200–700 R of unfiltered x-radiation, at a dose rate of 140 R/min from a 230 kV and 15 mA source, and at a target distance of 60 centimetres. The mice received food and water *ad libitum* before and after irradiation. One, two, four or seven days after irradiation, the mice were anaesthetized with ether and exsanguinated through the axillary artery. Blood and organs were rapidly collected avoiding water loss by evaporation. The organs were placed in pre-weighed tubes with 5 ml of ice cold 0.9% w/v NaCl solution (saline) containing 5.6 μM indomethacin (2 μg/ml) to prevent prostaglandin formation during processing (Vane, 1971). They were then weighed and homogenized, and the prostaglandins extracted by a modification of the method of Unger, Stamford & Bennett (1971). The homogenates were mixed with 5 ml of absolute ethanol and stored overnight at 4°C (Greaves & McDonald-Gibson, 1972). They were then washed twice with 10 ml of petroleum ether. The water-ethanol phase was acidified with formic acid to a pH below 3, and extracted with 10 ml of chloroform. The chloroform extract was dried at 30°C under reduced pressure and excess formic acid removed by flushing with oxygen-free nitrogen. Recovery of prostaglandin E_1 was determined with internal standards, and found to be in the range of 80–98%. Prostaglandins were assayed on rat stomach strips (Vane, 1957) superfused with Krebs solution which contained the mixture of antagonists used by Gilmore, Vane & Wyllie (1968); 95% O_2 and 5% CO_2 was continuously bubbled through the solution.

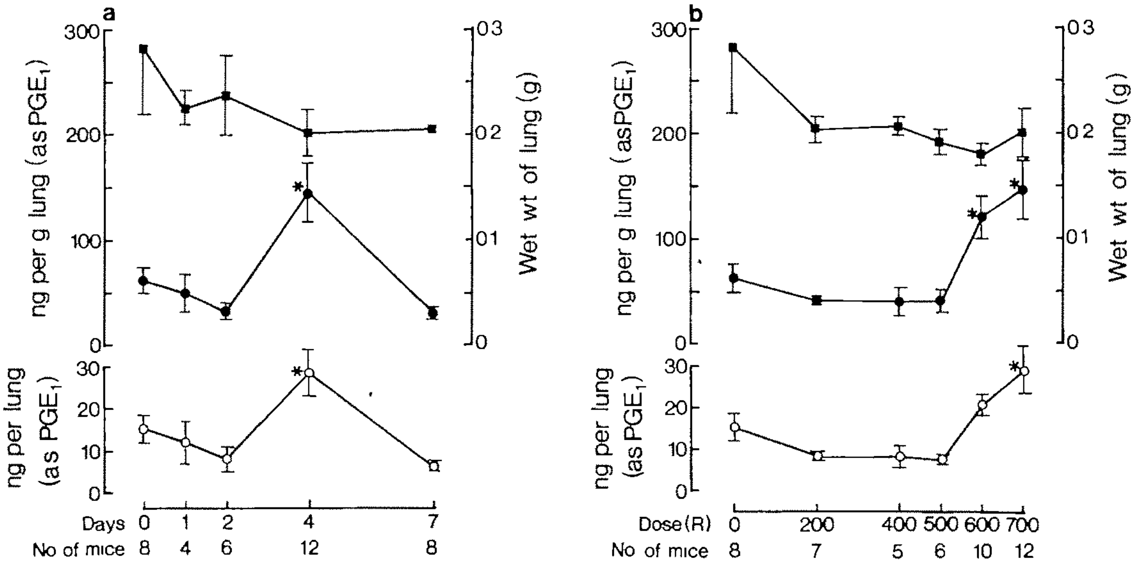

Figure 1 Effect of whole body exposure of mice to x-rays or prostaglandin-like activity in lung. (a) One to 7 days after exposure to 700 R, (b) 4 days after exposure to 200–700 R. Left-hand ordinate scales· prostaglandin (PG)-like activity (measured as PGE$_1$) per g wet wt. of lung (●, upper graph) and per lung (○, lower graph) Right-hand ordinate scale. fresh wet wt. of lungs (■, upper graph). Means ± s.e. mean are given; s.e. mean indicated by vertical lines, which are omitted when smaller than the symbol. Means significantly different from controls $^*P<0\ 05$; $^{**}P<0\ 01$

Processing in the presence of indomethacin invariably reduced the prostaglandin level found in a tissue, by more than 50 per cent.

Prostaglandins E and F were differentiated by thin layer chromatography. After removal of chloroform and formic acid, the dry tissue extracts were redissolved in 0.2 ml of chloroform and applied to aluminum-backed silica thin-layer chromatography plates (Merck & Co.). The plates were developed by the AII system of Green & Samuelsson (1964). Water–ethanol solutions of [5, 6, 8, 11, 12, 14, 15(n)-^{3}H]-prostaglandin E_2 (0.1 μCi; 0.625 pmol) and of [5, 6, 8, 11, 12, 14, 15(n)-^{3}H]-prostaglandin $F_{2\alpha}$ (0.2 μCi; 1.3pmol) were run on the same plates. For bioassays, 1 cm strips of the gel were scraped, placed in 2 ml of Krebs solution, thoroughly mixed, and then centrifuged. For counting in a Packard Tri-carb Scintillation System, the scraped gels were placed in vials containing 5 ml of scintillation fluid.

Degradation of prostaglandins by spleen homogenates was measured by a modification of the method of Bedwani & Marley (1975). Spleens from freshly killed mice were homogenized in Krebs solution modified by the addition of 3.6 mM $MgCl_2$ and 27.6 mM nicotinamide. Large particles were removed by centrifuging for 10 min at 4000 *g*; 0.5 ml aliquots of the supernatant were added to 4.5 ml of the modified Krebs solution containing also 2 mM NAD plus 0.5 μg of prostaglandin E_1. The reaction mixture was incubated at 30°C. Aliquots (0.1 ml) were taken at intervals and quickly frozen. They were melted and diluted 10 times with Krebs solution immediately before bioassay.

Inactivating potency was also measured in a crude preparation of soluble cytoplasmic enzymes. Spleen homogenates were centrifuged at 10,000 *g* for 10 minutes. The separated supernatant was centrifuged at 95,000 *g* for 70 minutes. The prostaglandin-destroying activity in the final supernatant was assayed as described, except that the supernatant constituted a larger proportion (25%) of the reaction mixture.

Results

The effect of a single exposure to 700 R on prostaglandin-like activity in blood, brain, seminal vesicles, small intestine, kidney, lung and spleen was examined. Little or no change was detected in brain, seminal vesicles and blood.

There was considerable scatter in the prostaglandin levels of the small intestine (from the pylorus to the caecum). A fall in the prostaglandin-like activity per g wet wt of intestine from a control level of 217.75 ± 50 ng (s.e. mean) to 132.42 ± 16.1 ng at day 2 after irradiation, and a subsequent rise to 422 ± 150 ng at day 7, were not significant ($P > 0.05$).

Prostaglandin-like activity per g of kidney fell from

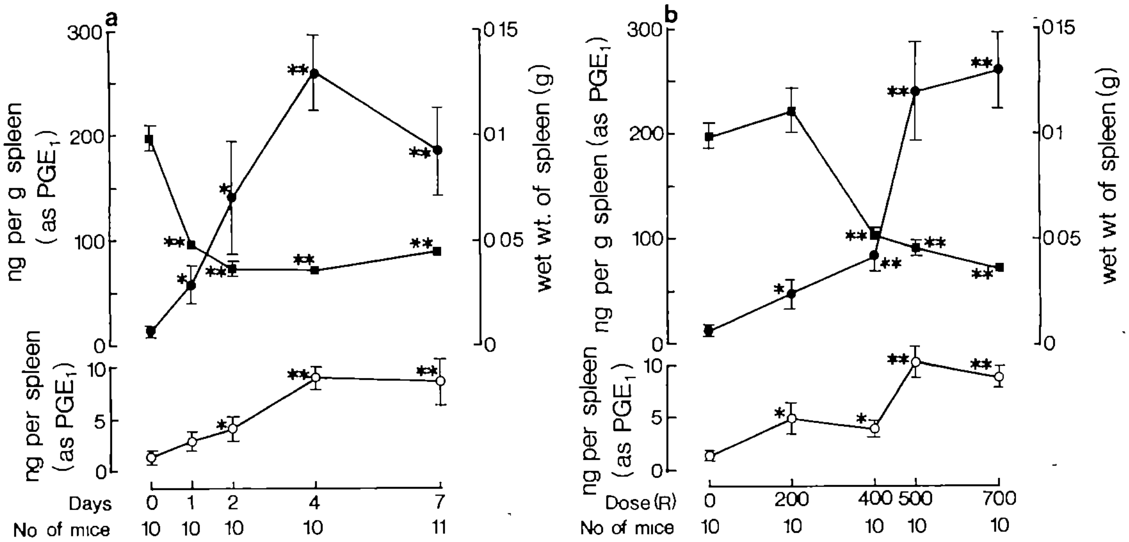

Figure 2 Effect of whole body exposure of mice to x-rays on prostaglandin-like activity in spleen (a) One to 7 days after exposure to 700 R; (b) 4 days after exposure to 200–700 R. Left-hand ordinate scales: prostaglandin (PG)-like activity (measured as PGE$_1$) per g spleen (●, upper graph) and per spleen (O, lower graph). Right-hand ordinate scale wet wt. of spleen (■, upper graph). For means, s.e. means, and P values see legend to Figure 1.

119 ± 43 ng (s.e. mean) in controls to 69.3 ± 8.9 ng at 2 days after irradiation with 700 R. It attained 210 ± 81.2 ng on day 4, and had decreased to 156 ± 22.5 ng on day 7. The difference between the levels on days 2 and 4 was significant ($P < 0.05$), but none of the irradiated groups differed significantly from control kidneys.

The most pronounced changes were found in lung and spleen, and these tissues were examined in greater detail. In the lung (Figure 1a) prostaglandin-like activity fell slightly ($P > 0.1$) for the first two days, and then rose to a sharp transient peak on day 4 (145 ± 28.0 ng, s.e. mean). On day 7, the activity was slightly lower than in non-irradiated lungs. The fall in wet weight 1–7 days after irradiation was not significant ($P > 0.05$).

Since highest levels were found 4 days after irradiation, mice were exposed to doses ranging from 200 to 700 R, and prostaglandin-like activity measured 4 days later (Figure 1b). Up to 500 R produced no significant change, whereas 600 R was nearly as effective as 700 R.

The spleen reacted very promptly to irradiation with 700 R (Figure 2a). After 24 h, most of the extensive weight loss had already occurred, and the rise in prostaglandin-like activity per g spleen was already significant. Highest concentrations (259 ± 36.6 ng s.e. mean) were found on day 4; this was a nearly 20-fold increase from control levels (13.2 ± 4.9 ng). The rate of increase on the 4 days following exposure appeared to be fairly constant at about 60 ng per g spleen per day. Seven days after exposure, the concentration of prostaglandins in the spleens was still some 15 times higher than in controls. In spite of the great reduction in size and weight of the spleens, the prostaglandin content per spleen was increased about six-fold.

Exposure of mice to doses of 200 to 700 R (Figure 2b) showed that 4 days later the group which had received 200 R had slightly enlarged spleens, whilst the greatest reduction in weight occurred in the dose-range between 200 and 400 R. In contrast, the greatest increase in prostaglandin-like activity was found between the groups given 400 and 500 R.

Identification of prostaglandin-like activity

Extracts of spleens from control mice and from mice irradiated with 700 R 4 days earlier, were examined by thin layer chromatography (Figure 3) using the AII system of Gréen & Samuelsson (1964). The distribution of prostaglandin-like activity was compared with that of [^{3}H]-prostaglandin E_2 and [^{3}H]-prostaglandin $F_{2\alpha}$.

Assays on the rat stomach strip showed that about two-thirds of the total activity in the spleen extracts resembled prostaglandin E_2 in its mobility in the AII

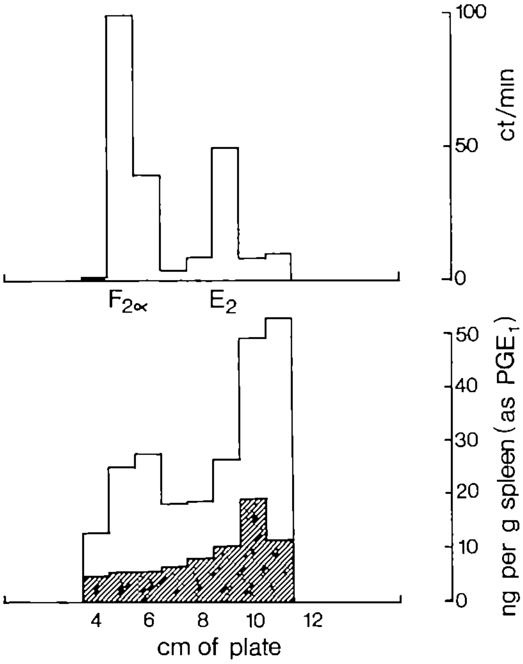

Figure 3 Thin layer chromatography of [^{3}H]-prostaglandins E_2 and $F_{2\alpha}$ (upper graph) and of extracts of spleens (lower graph) from mice irradiated with 700 R (clear area) and control mice (hatched area) Origin on left, solvent front on right.

system, whilst one-third resembled prostaglandin $F_{2\alpha}$. In these bioassays, all prostaglandin levels were measured and expressed in terms of the prostaglandin E_1 standards used. Since the rat stomach strip is five to ten times more sensitive to prostaglandins E than to prostaglandin $F_{2\alpha}$ (Vane, 1969), the assays would underestimate the amount of any prostaglandin $F_{2\alpha}$ present, and it is probable that the spleen extracts contained a higher proportion of prostaglandin $F_{2\alpha}$ than is suggested by Figure 3.

Irradiation slightly increased the proportion of activity due to prostaglandin $F_{2\alpha}$.

Effect of radiation on prostaglandin degradation

The possibility that radiation raised tissue levels of prostaglandins by depressing their enzymatic degradation was tested by measuring this process in spleens from control mice and from mice exposed to 700 R 4 days earlier. Figure 4a shows that prostaglandin E_1 was inactivated much faster by whole spleen homogenates (protein concentration 4.4 mg/ml) obtained from control mice, than by homogenates (protein concentration 6.4 mg/ml) from irradiated mice. In the soluble cytoplasmic fraction, inactivating potency per mg protein measured over 3 h at 30°C and pH 8.0 was also reduced (Figure 4b). To exclude the possibility that these results were distorted by

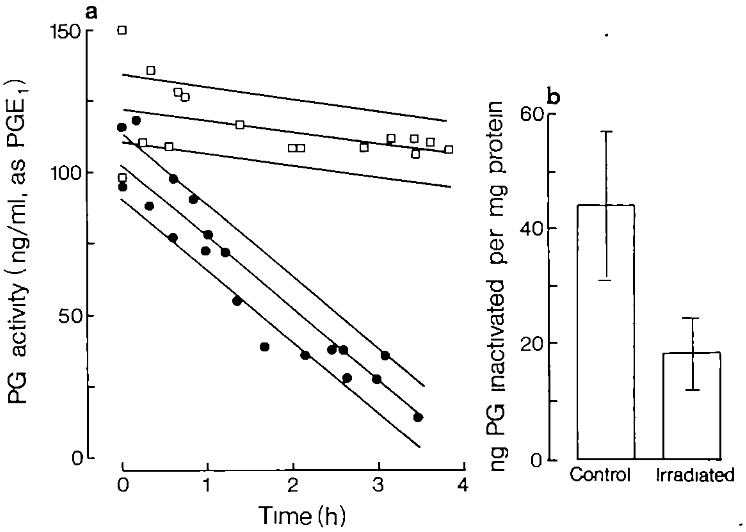

Figure 4 Effect of whole body exposure to 700 R on inactivation of prostaglandin (PG) by spleen tissue. Prostaglandin E_1, 100 ng/ml was added at 0 hours. (a) Time course of inactivation by homogenates (4 4 mg/ml) of spleens from control mice (●) and by homogenates (6.4 mg/ml) from mice irradiated 4 days earlier (□) Regression lines (calculated by method of least squares) ± s.d. of observed values are shown. Note that some initial values were raised above the total added prostaglandin E_1 by prostaglandin present in the homogenates (b) Inactivation of prostaglandin E_1 in 3 h at 30°C and pH 8.0, by 1 mg protein of soluble cytoplasmic fraction of spleen ($P < 0.1$)

concurrent prostaglandin synthesis, 7 μM indomethacin was added in some assays to the reaction mixture. This reduced the apparent rate of prostaglandin degradation suggesting that in the conditions of the assay no prostaglandin was formed; it also suggested that indomethacin depressed one or more steps of prostaglandin catabolism.

Discussion

The results strongly suggest that ionizing radiation disturbs the turnover of prostaglandins, particularly in the highly radiosensitive spleen. The effects were seen with doses of 500–700 R which are in the range of the LD_{50} for mice when estimated by survival 30 days after exposure. Whilst comparable exposure would not be applied clinically to the whole human body, individual sites and organs are often treated with very high doses.

Further work is required to determine which steps in the synthesis and/or inactivation of prostaglandins are affected. It is likely that several, if not all enzymes involved in these processes are altered after irradiation, possibly to various extents and by different dose-ranges. This implies that the resulting changes in prostaglandin levels will not show a clear-cut dose-response relationship. The finding that irradiated spleen inactivated prostaglandin E_1 much more slowly, may be mainly due to reduced activity of 15-hydroxy-prostaglandin dehydrogenase (PGDH). In the kidney and lung, PGDH is short-lived and its activity falls rapidly when cellular protein synthesis is inhibited by cycloheximide or puromycin (Blackwell, Flower & Vane, 1975). Since x-rays depress synthesis of many proteins in lymphoid tissues (Altman *et al.*, 1970), similar falls in splenic PGDH levels may be expected. Since the assay system contained primarily the co-factors required by PGDH, it is probable that indomethacin inhibited prostaglandin degradation by acting on PGDH. Evidence that indomethacin and other analgesics inhibit prostaglandin catabolism is listed by Flower (1974).

The observed effects on prostaglandin levels were not closely related to the radiosensitivity of the organs. For example, prostaglandin levels rose considerably in the fairly radioresistant lung, but changed only little in the highly sensitive intestine. It should be remembered however, that most organs contain elements of diverse radiosensitivity. In the lung, alveolar cells of type II have a three times higher rate of turnover than type I cells, and are therefore more sensitive to radiation (Bertalanffy & Leblond, 1953). Alveolar macrophages are prone to damage by many noxae, amongst them immunosuppressive agents (Harris, Swenson & Johnson, 1970). Capillary endothelial cells resemble type I cells in their low turnover rate.

The fall in size and weight of the spleen occurs within hours of exposure to high doses of radiation, and is mainly due to pyknotic changes and death of the highly radiosensitive lymphoid cells of the white pulp. Myeloid cells which constitute a considerable part of the mouse spleen, are less sensitive. The damaged lymphoid cells are promptly ingested by macrophages and reticulum cells (Jordan, 1967). Phagocytosis is maximal 3 h after exposure, and almost complete at 24 h; there is little sign of it after 3 days. This process could contribute to accumulation of prostaglandins in the spleen, since Higgs, McCall & Youlten (1975) found that white blood cells engaged in phagocytosis release prostaglandins which attract further phagocytes. However, highest prostaglandin levels were found 4 days after irradiation; at this time, phagocytic activities have subsided and regenerative mitoses are only just beginning (Jordan, 1967).

The role of higher prostaglandin levels in the reactions to ionizing radiation is not yet known. In view of the pharmacological properties of prostaglandins, it is possible that they contribute to some of the signs of radiation sickness, such as diarrhoea, nausea and pain. Mennie, Dalley, Dinneen & Collier (1975) have therefore examined the effect of inhibition of prostaglandin synthesis by acetylsalicylate in patients with gastrointestinal distress caused by radiotherapy. Abdominal pain, flatulence and bowel motions were significantly reduced.

On the other hand, a possible radioprotective role of prostaglandins cannot be excluded. Prasad (1972) found that prostaglandin E_1, and other agents which raise the cellular level of cyclic adenosine 3′,5′-monophosphate (cyclic AMP) reduce *in vitro* radiation damage. This may be achieved by the depression of cell growth by cyclic AMP. Prostaglandins E could also protect from the effects of radiation by their ability to stimulate haemopoiesis (Fehér & Gidáli, 1974), and by acting as calcium ionophores (Kirtland & Baum, 1972) which increase the calcium content in cells thereby rendering them more resistant to radiation.

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INTERACTIONS OF ISOPRENALINE AND PROSTAGLANDIN E_2 WITH RESPECT TO MYOCARDIAL CONTRACTILE FORCE, CORONARY VASCULAR RESISTANCE AND MYOCARDIAL OXYGEN CONSUMPTION IN GUINEA-PIG ISOLATED HEARTS

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1 Left ventricular pressure (LVP), left ventricular pressure derivative (LV dp/dt_{max}), coronary vascular resistance (CVR) and myocardial oxygen consumption (Qo_2) were measured simultaneously in isolated, electrically driven hearts of guinea-pigs at constant perfusion rate.

2 LVP, LV dp/dt_{max}, CVR and Qo_2 were greatly decreased by either the addition of prostaglandin E_2 (50 ng/ml) to the perfusion fluid or pretreatment of the animals with reserpine.

3 Isoprenaline (0.5 nM to 100 nM) induced increases in LVP, LV dp/dt_{max} and Qo_2. In the presence of prostaglandin E_2, there was a parallel shift of the isoprenaline concentration-response curve for LVP and LV dp/dt_{max}. This effect was not seen, after the animals had been treated with reserpine.

4 Qo_2 was also decreased by prostaglandin E_2 only in non-reserpine treated animals.

5 CVR was diminished by isoprenaline in the untreated group. However, there was increase in CVR, when isoprenaline was added to either prostaglandin E_2 or reserpine-pretreated hearts which was enhanced in the reserpine plus prostaglandin E_2-treated group ($P < 0.01$).

6 The results give evidence for different actions of prostaglandin E_2 on isoprenaline concentration-response curves for LVP, LV dp/dt_{max} and CVR.

Introduction

Both prostaglandin E_1 and E_2 inhibit the overflow of noradrenaline as well as inotropic and chronotropic responses following sympathetic nerve stimulation in the isolated perfused heart of the rabbit, while prostaglandin $F_{2\alpha}$ is ineffective (Hedqvist & Wennmalm, 1971). In the same study no influence of these compounds on the effects of exogenously added noradrenaline was observed and a mainly presynaptic action of E type prostaglandins was assumed. However, these results were only partially confirmed by Baum & Shropshire (1971) and Bhagat, Dhalla, Ginn, LaMontagne & Montier (1972), whereas Dhalla & Balasubramanian (1972) found prostaglandin E_2 had no influence on release, but inhibited uptake of [^{3}H]-noradrenaline in the rat heart. Thus, the results are conflicting with respect to the mechanism of interaction between noradrenaline and prostaglandins of the E-series.

The effects of isoprenaline on the performance of the dog heart and the myocardial fibrillation threshold of the cat were found to be inhibited by the addition of prostaglandin E_2 (Schrör & Forster, 1974; and unpublished), but not by prostaglandin $F_{2\alpha}$ (Förster, Schrör & Weiss, 1975). This could be taken as evidence for post-junctional inhibition by prostaglandin E_2 of catecholamine-induced increase in myocardial performance and excitability, since isoprenaline is assumed not to be inactivated by neuronal uptake mechanisms (Bönisch & Trendelenburg, 1974). However, in whole animal experiments, the participation of endogenous catecholamines, even with respect to the effects of isoprenaline, cannot be excluded.

Hence, the interaction between isoprenaline and prostaglandin E_2 on myocardial performance was studied in isolated heart preparations when the heart rate was held constant. In order to prevent limitations of oxygen availability, especially at high isoprenaline concentrations, Po_2 was measured in the venous effluent in addition to coronary vascular resistance. Because it became evident from earlier studies on the same model, that the effects of prostaglandin E_2 are closely dependent on the endogenous catecholamine content of the preparations (Krebs & Schrör, 1975a; 1975b; Schrör & Krebs, 1975), the experiments were performed in both reserpine-treated and non-reserpine-treated animals.

Methods

Heart preparations

In guinea-pigs of either sex (300–400 g body weight) thoracotomy was performed under light ether anaesthesia after pretreatment with heparin (10 mg/kg i.p.). After the aorta and pulmonary artery had been cannulated, all other vessels near the heart were ligated and the heart placed in the perfusion apparatus.

During the experiments the heart was perfused at constant flow via a metallic aortic cannula with Tris buffered Tyrode solution (pH 7.4) containing 1.8 mM Ca^{2+}, equilibrated with 95% O_2 and 5% CO_2 at 32°C and electrically stimulated through the aortic cannula at a constant rate of 180 beats/min (Grass stimulator S5, impulse duration 4 ms, 40 V).

Mean coronary perfusion pressure was measured by Statham P 23 Bb pressure transducer in the aorta, immediately distal to the aortic valves and was considered to be a direct expression of coronary vascular resistance (CVR), since the perfusion rate was held constant.

Myocardial oxygen consumption (Qo_2) was calculated from the oxygen partial pressure in the pulmonary artery outflow, as measured by polarography, using platinum electrodes (Clark principle) (Klaus & Krebs, 1969).

A fluid filled rubber balloon catheter was inserted into the left ventricle through the mitral ostium for measurement of left ventricular actively developed pressure (LVP) and left ventricular dp/dt_{max} (LV dp/dt_{max}) using a Statham P 23 Db pressure transducer. Left ventricular diastolic pressure was zero. Under these experimental conditions changes in the LVP, as measured by the compression of the balloon, are therefore assumed to be a direct expression of alterations in the left ventricular afterload.

Design of the experiments

Two series of experiments were performed. The animals of the first series served as controls and were divided into three groups. The animals of the first group received no drugs and were used to study the time of constant performance of the preparations. The second group of animals were pretreated with reserpine (7 mg/kg i.p. once 16–24 h prior to surgery), and then checked for the degree of depletion in the cardiac catecholamine stores by addition of tyramine 1 µg/ml (final concentration) to the bath fluid. The hearts of the third group were also pretreated with reserpine in the same way and then incubated with indomethacin at a final concentration of 0.16 µg/ml, to obtain information on the possible role of endogenous prostaglandin-like substances for myocardial performance and Qo_2.

The animals of the second series ($n=64$) were divided into 2 groups. The first group ($n=38$) was pretreated with reserpine as described above. The second group ($n=26$) was not pretreated. Half the animals from each group were randomly selected for treatment with prostaglandin E_2. After the preparations had been stabilized, isoprenaline sulphate was added in a cumulative way (0.5, 1, 5, 10, 50 and 100nM) in the presence or absence of prostaglandin E_2 (final concentration 50 ng/ml perfusion fluid). In earlier investigations, in which the prostaglandin E_2 concentration-response curve was studied using these parameters and the same model, this concentration was found to be maximally active (Krebs & Schrör, 1975b).

Experiments were started after an equilibration period of about 30 min and did not last longer than 90 minutes.

Drugs

The following drugs were used: tyramine chloride (Merck), isoprenaline sulphate (Boehringer, Ingelheim), reserpine (Serpasil, CIBA), prostaglandin E_2 (Prostin E_2, Upjohn) and indomethacin (Sharp & Dohme). Stock solutions of prostaglandin E_2 were prepared as follows: 5 mg was dissolved in 0.5 ml 95% ethanol; 4.5 ml Na_2CO_3 (20 mg/100 ml) was added, the final pH checked (6–7.5) and the solution stored frozen at −25°C for not longer than 1 month. From this stock a more dilute solution, containing 5 µg/ml prostaglandin E_2 was prepared, immediately before the experiment, and an aliquot was added to the perfusion fluid to give the final concentration required.

Statistical analysis

Statistical evaluation was performed using the *t*-test for non-paired observations. The mean and standard error ($\bar{x} \pm$ s.e. mean) are quoted in the text. The level of significance for α was 0.01.

For the isoprenaline concentration-response relationship, a two-way regression analysis for dependent observations was made over the log-linear part of the respective concentration-response curve, by computing the coefficient of correlation (r), slope (b), intercept on the y axis (a) and the 95% confidence interval (programme MED 00 402, Prof. J. Berger, Institut für Medizinische Statistik und Dokumentation der Universität Mainz). n is the number of observations.

Results

First series of experiments

Time of constant performance of the preparations. In the first group of this series, LVP

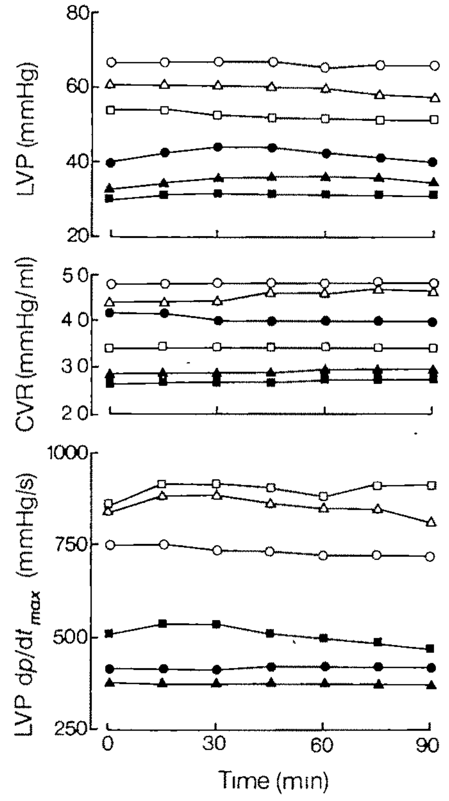

Figure 1 Changes in LVP, CVR and LV dp/dt_{max} in 3 reserpine-treated (closed symbols) and 3 non-reserpine-treated (open symbols) guinea-pigs as a function of time. Measurements were made every 15 min after stabilization (time 0) of the preparation.

(mmHg), LV dp/dt_{max} (mmHg/s), CVR (mmHg/ml) and Q_{O_2} (µl O$_2$ per g ventricular dry weight/min) were checked for constancy over a time period of 90 min after stabilization of the preparations in non-reserpine-treated ($n=3$) and reserpine-treated ($n=3$) animals. No changes in any of these parameters in dependence on the time were observed ($P>0.01$). The respective results for LVP, LV dp/dt_{max} and CVR for each animal are shown in Figure 1. Note the influence of reserpine-treatment. Thus, at least for this period, it may be assumed that the heart preparations maintain a stable performance under our experimental conditions.

Degree of depletion of the cardiac noradrenaline stores by reserpine pretreatment. The actual degree of catecholamine depletion by reserpine pretreatment was checked in another group of this series, when the heart preparations were given tyramine at a final concentration of 1 µg/ml ($n=8$). As summarized in Table 1, there were essentially no changes in any of the parameters measured, when the respective values before and in the presence of tyramine were compared ($P>0.01$). Thus, sufficient depletion of the cardiac noradrenaline stores may be assumed.

Actions of indomethacin. In order to obtain information on the possible role of endogenous prostaglandin-like substances for myocardial performance and Q_{O_2}, indomethacin at a final concentration of 0.16 µg/ml was added to the bath fluid of 7 reserpine-pretreated heart preparations. By this procedure, the LVP was altered to 35 ± 2 mmHg (before: 36 ± 2), the LV dp/dt_{max} to 468 ± 35 mmHg/s (before: 441 ± 24) and the Q_{O_2} to 250 ± 20 µl O$_2$ per g ventricular dry weight/min (before: 247 ± 22). Thus these parameters were not affected by the presence of indomethacin ($P>0.01$). The same was true for the solvent ethanol (final concentration 0.01 vol.%). Increase of the indomethacin-concentration up to 0.5 µg/ml in 3 additional experiments was also without any effect on these parameters, thus providing evidence that endogenous prostaglandin-like substances are not involved in the maintenance of myocardial performance or Q_{O_2} in these animals.

Second series of experiments

Actions of prostaglandin E$_2$ in non-reserpine-treated group. Table 2 shows that prostaglandin E$_2$

Table 1 LVP (mmHg), LV dp/dt_{max} (mmHg/s), CVR (mmHg/ml) and Q_{O_2} (µl O$_2$ per g ventricular dry wt./min) in reserpine-pretreated animals before (control) and in presence of 1 µg/ml tyramine (tyramine)

Group	*LVP*	*LV dp/dt$_{max}$*	*CVR*	*Q_{O_2}*
Control	40 ± 3	477 ± 28	3.25 ± 0.27	246 ± 17
Tyramine	43 ± 3	567 ± 46	3.31 ± 0.28	256 ± 17
% change	+ 7.5	+ 18.9	+ 1.8	+ 4.1
Significance	NS	NS	NS	NS

$n=8$. The means, standard errors ($\bar{x}$ ± s.e. mean) and the percentage change caused by tyramine (control = 100%) are given. Level of significance for α: 0.01.

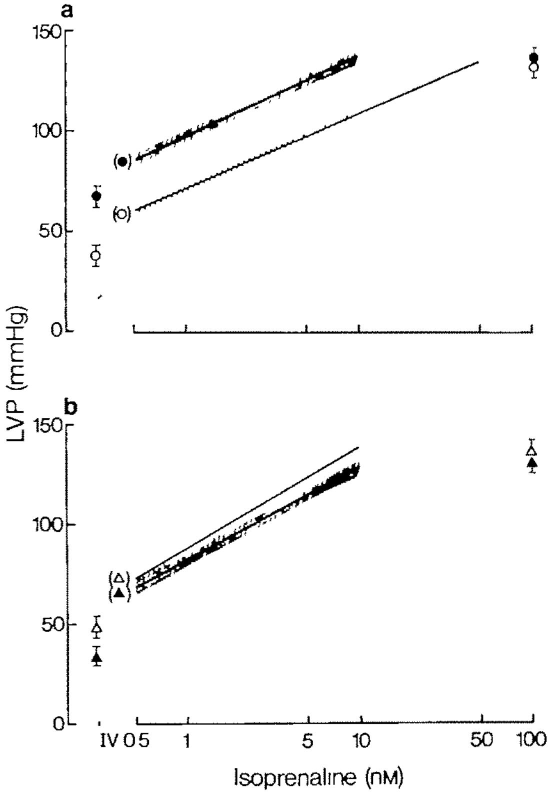

Figure 2 Isoprenaline concentration-response curve for LVP in (a) non-reserpine-treated and (b) reserpine-treated animals in the presence (open symbols) or absence (closed symbols) of 50 ng/ml prostaglandin E_2. The log-linear part of the concentration-response curve with the 95% confidence limit is given. The respective initial values (IV) and values at 100 nM isoprenaline ($\bar{x} \pm$ s e. mean) are also indicated. $n=56$ (●), $n=55$ (○), $n=72$ (▲); $n=72$ (△).

(50 ng/ml) leads to a marked decrease in LVP, LV dp/dt_{max}, CVR and Qo_2 ($P<0.01$). Moreover, it is noticeable, that the decrease in LVP, LV dp/dt_{max} and CVR is as much as 40–50% of the control values, whereas Qo_2 is only diminished by 17%.

Actions of prostaglandin E_2 in the reserpine-pretreated group. Reserpine-treatment itself diminished LVP and LV dp/dt_{max} as well as CVR and Qo_2 significantly by about 41, 52, 32 and 31%, respectively (non-prostaglandin E_2-treated groups in Tables 2 and 3). Prostaglandin E_2 (50 ng/ml) produced no further decrease in myocardial mechanics, but rather increased LVP and LV dp/dt_{max}, 23 and 30%, respectively; increases which were not statistically significant ($P>0.01$). Qo_2 was also not altered, but the CVR diminished to almost the same extent as in the non-reserpine-treated group, i.e. by 32.7%, when compared with the respective initial value ($P<0.01$) (Table 3).

Isoprenaline concentration-response curves. The isoprenaline concentration-response curves for LVP, LV dp/dt_{max}, CVR and Qo_2 as influenced by prostaglandin E_2, reserpine pretreatment or both prostaglandin E_2 and reserpine pretreatment are shown in Figures 2–5. The respective isoprenaline concentration-response curves with the 95%-confidence limit are given as obtained by computer analysis for the log-linear part of each curve. The initial values immediately before addition of isoprenaline and the final values at 0.1 μM (100 nM) ($\bar{x} \pm$ s.e. mean) are also given; *n* refers to the number of observations for the log-linear part of the isoprenaline concentration-response curve.

Left ventricular pressure. Addition of isoprenaline was followed by a concentration-dependent increase in LVP up to a final value of 130–140 mmHg, which was essentially the same for all groups ($P>0.01$), despite the different initial values. For the non-

Table 2 Changes in LVP (mmHg), LV dp/dt_{max} (mmHg/s), mean CVR (mmHg/ml) and Qo_2 (μl O_2 per g ventricular dry wt/min) without and in presence of prostaglandin E_2 (PGE_2) 50 ng/ml in non-pretreated animals

Group	*LVP*	*LV dp/dt_{max}*	*CVR*	*Qo_2*
No PGE_2	66±4	965±52	4.05±0.24	396±21
Plus PGE_2	39±4	498±42	2.45±0.21	329±20
% change	−41.9	−48.4	−39.5	−16.9
Significance	+	+	+	+

$n=12$ The means, standard errors ($\bar{x} \pm$s.e. mean) and the percentage change by prostaglandin E_2 (no $PGE_2=100\%$) are given Level of significance for α: 0.01.

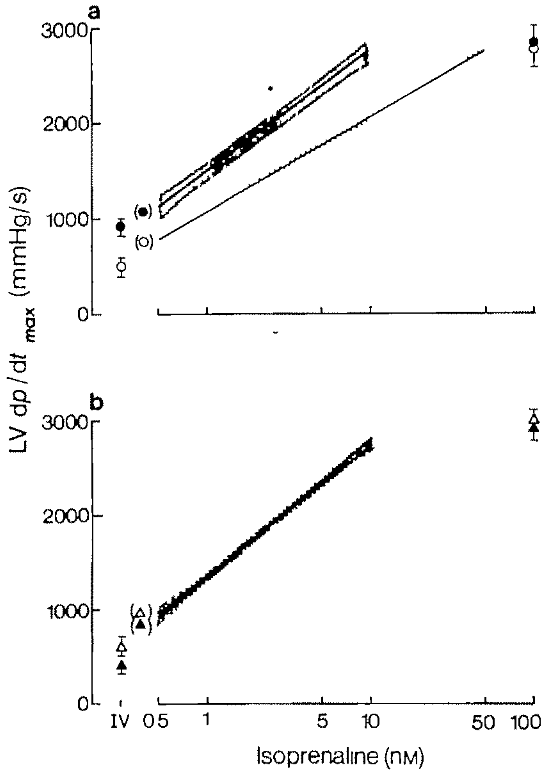

Figure 3 Isoprenaline concentration-response curve for LV dp/dt_{max} in (a) non-reserpine-treated and (b) reserpine-treated animals in the presence (open symbols) or absence (closed symbols) of 50 ng/ml prostaglandin E$_2$ The log-linear part of the concentration-response curve with the 95% confidence limit is given. The respective initial values (IV) and values at 100 nM isoprenaline ($\bar{x}$ ± s.e. mean) are also indicated. $n=56$ (●); $n=55$ (O); $n=72$ (▲); $n=72$ (△).

reserpine-treated group, a plateau was reached at 10 nM isoprenaline, which, in presence of prostaglandin E$_2$ (50 ng/ml) was only seen after 50 nM isoprenaline, thereby shifting the concentration-response curve to the right in a parallel manner, as confirmed statistically by comparing the slope and the confidence limits for both groups (Figure 2, circles).

After pretreatment with reserpine, the isoprenaline concentration response curve was essentially unchanged, whether prostaglandin E$_2$ was present or not (Figure 2, triangles). Furthermore as seen for the non-reserpine-treated animals not treated with prostaglandin E$_2$, concentrations of isoprenaline greater than 10 nM caused no further increase in LVP.

Left ventricular pressure derivative (LV dp/dt$_{max}$). Addition of isoprenaline was also followed by a concentration-dependent increase in LV dp/dt_{max} up to a final value of 2900–3000 mmHg/s, which was essentially the same for all groups ($P>0.01$), despite the different initial values.

In the non-reserpine-treated group a plateau was again observed at 10 nM isoprenaline, which in the presence of prostaglandin E$_2$ was only found after 50 nM isoprenaline was added, thereby shifting the concentration-response curve in a similar manner as shown for LVP (Figure 3, circles).

After pretreatment with reserpine, no further influence by prostaglandin E$_2$ on the isoprenaline-induced increase in LV dp/dt_{max} was found. Again, there was no further change in this parameter, in the presence of concentrations greater than 10 nM isoprenaline, whether prostaglandin E$_2$ was present or not (Figure 3, triangles).

Coronary vascular resistance (CVR). As seen with myocardial contractile force there were also concentration-dependent changes in CVR induced by isoprenaline. Both the slope and degree of these

Table 3 Changes in LVP (mmHg), LV dp/dt_{max} (mmHg/s), mean CVR (mmHg/ml) and Q_{O_2} (µl O$_2$ per g ventricular dry wt./min) without and in presence of prostaglandin E$_2$ (PGE$_2$) 50 ng/ml in reserpine-treated animals

Group	*LVP*	*LV dp/dt$_{max}$*	*CVR*	Q_{O_2}
No PGE$_2$	39±3	465±38	2.76±0.31	272±15
Plus PGE$_2$	48±4	605±51	1 86±0.15	279±14
% change	+23.0	+30.1	−32.7	+2.5
Significance	NS	NS	+	NS

$n=19$. The means, standard errors ($\bar{x}$ ± s e. mean) and the percentage change by prostaglandin E$_2$ (no PGE$_2$ = 100%) are given. Level of significance for α: 0.01.

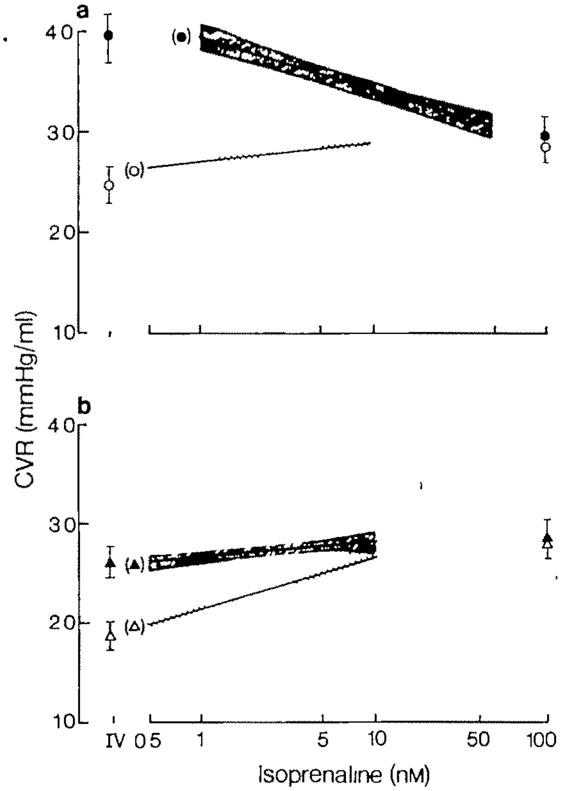

Figure 4 Isoprenaline concentration-response curve for CVR in (a) non-reserpine-treated and (b) reserpine-treated animals in presence (open symbols) or absence (closed symbols) of 50 ng/ml prostaglandin E_2. The log-linear part of the concentration-response curve with the 95% confidence limit is given. The respective initial values (IV) and values at 100 nM isoprenaline ($\bar{x} \pm$ s.e. mean) are also indicated. $n=48$(●); $n=44$ (○); $n=72$ (▲); $n=43$ (△).

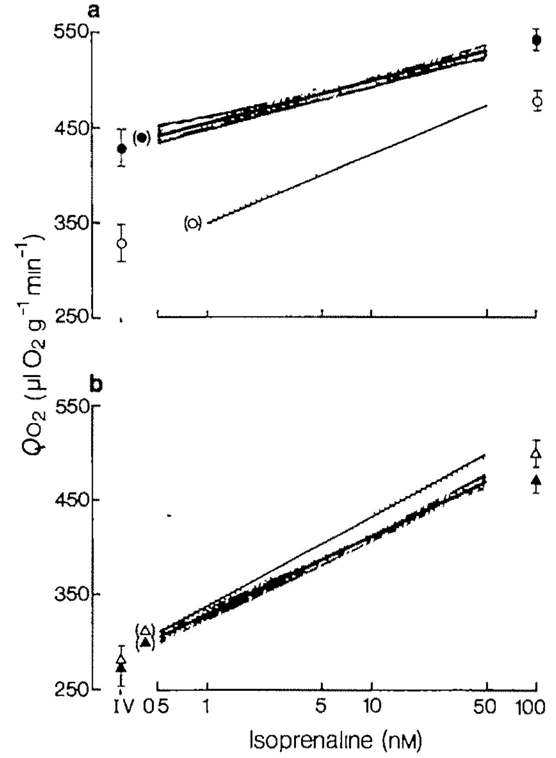

Figure 5 Isoprenaline concentration-response curve for Qo_2 (µl O_2 per g ventricular dry wt/min) in (a) non-reserpine-treated and (b) reserpine-treated animals in presence (open symbols) or absence (closed symbols) of 50 ng/ml prostaglandin E_2. The log-linear part of the concentration-response curve with the 95% confidence limit is given. The respective initial values (IV) and values at 100 nM isoprenaline ($\bar{x} \pm$ s.e. mean) are also indicated. $n=70$ (●), $n=44$ (○); $n=90$ (▲), $n=90$ (△).

alterations were quite different in the single experimental groups, however, very good agreement between all means in CVR were observed at maximum isoprenaline concentration, ranging between 2.78–2.96 mmHg/ml ($P > 0.01$).

Isoprenaline in the non-reserpine-treated group led to a marked decrease in CVR in concentrations of 1 nM to 50 nM by about 25%. In contrast to that, the presence of prostaglandin E_2 caused a small but significant increase in CVR, when isoprenaline was added in concentrations between 0.5 nM to 10 nM ($P < 0.01$). The marked influence of prostaglandin E_2 alone should be noted (see also Table 2) (Figure 4, circles).

Isoprenaline in reserpine-treated animals produced essentially the same increase in CVR as shown in presence of prostaglandin E_2 for non-reserpine-treated animals (Figure 3, closed triangles). However, this increase was significantly greater, if prostaglandin E_2 was also present, starting at the absolutely lowest level measured in these experiments, i.e. 1.86 ± 0.15 mmHg/ml (Figure 4, open triangles).

Myocardial oxygen consumption (Qo_2). Isoprenaline caused concentration-dependent increases of Qo_2 in all groups.

In the non-reserpine-treated animals isoprenaline produced greatest Qo_2, i.e. 544 ± 12 µl per g ventricular dry wt./min at the concentration of 100 nM. In the presence of prostaglandin E_2 this concentration-response relationship was altered significantly: elevations in Qo_2 were obtained first at 1 nM isoprenaline and the curve shifted downwards, i.e. the maximum Qo_2 at 100 nM isoprenaline was only 483 ± 12 µl per g ventricular dry wt./min ($P < 0.01$) (Figure 5, circles).

After the animals had been treated with reserpine, no further influence of prostaglandin E_2 on the isoprenaline concentration-response curve could be detected (Figure 5, triangles). However, it should be noted, that the maximum Qo_2 for the reserpine plus isoprenaline treated group (isoprenaline concentration 100 nM) is only 469 ± 9 µl per g ventricular dry wt./min, i.e. significantly lower than without previous reserpine-treatment ($P < 0.01$).

The Po_2 in the efflux of the pulmonary artery under all conditions was higher than 200 mmHg.

Discussion

A parallel shift in isoprenaline-induced increase in LVP and LV dp/dt_{max} could be observed in non-pretreated animals, thus confirming earlier results, obtained *in situ*, where prostaglandin E_2 was found to inhibit isoprenaline-induced changes in myocardial performance (Schrör & Förster, 1974) and fibrillation threshold (Schrör & Förster, unpublished). However, the isoprenaline concentration-response curve for LVP and LV dp/dt_{max} remained essentially unchanged, whether prostaglandin E_2 was present or not in reserpine-treated animals. These differing results support the assumption, that prostaglandin E_2 does not directly influence these isoprenaline concentration-response relationships but indirectly, through a factor which is removed by previous reserpine-treatment.

Much evidence suggests this factor is the endogenous catecholamine content of the heart. As shown by the addition of tyramine, there is adequate depletion of cardiac catecholamine stores by reserpine-treatment. According to this, there is also a sharp drop in myocardial contractile force produced by reserpine-treatment, which is also found after prostaglandin E_2 is added, but only in non-reserpine-treated animals. Indomethacin treatment did not alter contractile force or Qo_2 in reserpine-treated animals, indicating that endogenous prostaglandin-like substances should not mask any intrinsic contractile action of prostaglandin E_2.

Therefore the endogenous catecholamines seem to be involved in maintenance of cardiac performance in non-pretreated animals. Most probably, the electrical stimulation of the heart through the aortic cannula leads also to stimulation of cardiac sympathetic fibres, thereby liberating noradrenaline, if present. Stimulation frequencies of 3 Hz with square wave impulses of less than 5 ms duration are well known to induce liberation of noradrenaline (Junstadt & Wennmalm, 1973). However, at the low current of about twice threshold strength, there may be no exhaustion of catecholamine stores, as seen from the constant performance of the preparations in the experiments of the first series.

The inability of prostaglandin E_2 to inhibit actions of isoprenaline in catecholamine-depleted animals supports the view that, with respect to left ventricular pressure development and dp/dt_{max}, there is no post-junctional interaction between isoprenaline and prostaglandin E_2. Hence, the shift in the isoprenaline concentration-response curve for the myocardial contractile force in non-reserpine-treated animals could be explained in terms of prejunctional inhibition of noradrenaline release by prostaglandin E_2. Interestingly, this mechanism seems to be operative up to the highest isoprenaline concentrations, in essentially the same manner, because these curves are parallel. Thus, one may assume that endogenous noradrenaline is not only involved in the maintenance of cardiac performance under control conditions but also under conditions of enhanced myocardial activity, because isoprenaline is known not to undergo presynaptic reuptake (Bönisch & Trendelenburg, 1974) and thus should not interfere directly with presynaptic noradrenaline release or reuptake.

This hypothesis is supported by the result, that the isoprenaline concentration-response curve seems to be shifted in a similar way both by reserpine-treatment and by prostaglandin E_2 in non-reserpine-treated animals. Furthermore, prostaglandin E_2 decreased LVP and LV dp/dt_{max} in a concentration-dependent fashion only in control, but not in reserpine-treated animals (Krebs & Schrör, 1975b). Finally, such effects could be obtained only with prostaglandin E_2 but not with $F_{2\alpha}$ (Schrör & Krebs, 1975), in agreement with observations *in situ* (Förster, Schrör & Weiss, 1975). In contrast to prostaglandin E_2, $F_{2\alpha}$ is assumed to exert no effect on nerve-stimulation-induced increase in myocardial performance by interaction with prejunctional mechanisms (Hedqvist, 1973).

On the other hand, a decrease in CVR induced by prostaglandin E_2 was found in both reserpine-treated and non-treated groups, giving further evidence for a different action of prostaglandin E_2 on myocardial contractile force and CVR.

This additional relaxing effect of prostaglandin E_2 in the reserpine-treated group could be explained by further reduction of some residual catecholamine release or by a direct dilating action of the prostaglandin. This effect was concentration-dependent (Krebs & Schrör, 1975b) and the release of noradrenaline was shown to be only partially inhibited by prostaglandin E_2 (Hedqvist & Wennmalm, 1971), arguments in favour of a direct relaxing action.

In agreement with the observations of Bassenge, Walter & Doutheil (1967), initial vascular tone had a considerable influence on the coronary actions of catecholamines. Accordingly, isoprenaline decreased CVR only if the initial tone was high, i.e. in the non-reserpine-treated group, but could produce a slight increase, if the tone was reduced by either reserpine or prostaglandin E_2. At the lowest level of CVR, i.e. 1.86 mmHg/ml in the reserpine plus prostaglandin E_2-treated group, this increase was significantly more pronounced, than with prostaglandin E_2 or reserpine alone. This could be explained by an influence of intramural pressure, which in our experimental conditions is only detectable, if the vascular component of coronary resistance is negligibly low. On the other hand, Trendelenburg (1974) in experiments on the isolated nictitating membrane found isoprenaline to act via both α-(contraction) and β-(relaxation) adrenoceptors and the reaction to be markedly dependent on the initial contractile state of the preparation. As coronary arteries are assumed to possess both β- and α-adrenoceptors (Zuberbuhler & Bohr, 1965) the different actions of isoprenaline on CVR as influenced by prostaglandin E_2 and reserpine may be understood on the basis of enhanced α-adrenergic activity under conditions of low coronary vascular tone.

There is no evidence that either CVR or myocardial contractile force was affected by hypoxia. The $P\mathrm{o}_2$ in the effluent under all experimental conditions was higher than 20 mmHg, which strongly suggests that sufficient oxygen was available to the heart. Alterations in $Q\mathrm{o}_2$, therefore, resembled the changes in LVP and LV dp/dt_{max} in many respects, in particular the isoprenaline concentration-dependent increase and the shift of those curves by prostaglandin E_2 in only non-reserpine-treated animals. The same is true for the respective initial values. However, striking differences are also detectable.

The increases in LVP and LV dp/dt_{max}, produced by isoprenaline in the non-reserpine-treated group were 100% and 209% over the initial value, respectively. On the other hand, the $Q\mathrm{o}_2$ was only enhanced by about 27%. Similar results, greater alterations in contractile force than in the oxygen demands, were also found for the other groups, including changes after reserpine-treatment or prostaglandin E_2 alone.

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IS THE CONTRACTILE RESPONSE TO EXOGENOUS ACETYLCHOLINE DUE TO A PRESYNAPTIC EFFECT?

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1 Whether the contractile response induced by exogenous acetylcholine (ACh) chiefly involved the pre- or post-synaptic junctional site of the motor endplate was studied by using the cat gastrocnemius nerve muscle preparation poisoned with β-bungarotoxin (β-BuTX), a toxin isolated from the venom of *Bungarus multicinctus* which acts presynaptically.

2 After neuromuscular transmission was completely blocked by β-BuTX, the dose-response curve of the contractile response induced by close intra-arterial injection of ACh, was compared with that of the control. No appreciable difference was observed.

3 In contrast, the response to ACh was completely abolished when neuromuscular transmission was blocked by α-bungarotoxin, a toxin isolated from the same venom which acts postsynaptically.

4 It is concluded that postjunctional site of the motor end-plate is chiefly involved in the contractile response produced by exogenous ACh.

Introduction

Acetylcholine (ACh) has been considered as a neuromuscular transmitter which is synthesized in and released from the motor nerve terminal (for review, see Hubbard, 1973). However, Riker and his colleagues have claimed that intra-arterial ACh depolarizes the motor nerve endings, the *in vivo* contractile response of the innervated muscle to ACh being largely a result of this action and concluded that the functional integrity of the unmyelinated terminals is essential for the action of ACh (Riker, 1966; Okamoto & Riker, 1969; Riker & Okamoto, 1969). Recently, Okamoto, Longenecker, Riker & Song (1971) reported that the contractile response to exogenous ACh was severely impaired in the cat soleus and gastrocnemius muscles poisoned with the venom of black widow spider (*Latrodectus mactans tredecimguttatus*), which selectively destroys motor nerve endings (Clark, Mauro, Longenecker & Hurlbut, 1970; Okamoto *et al.*, 1971; Clark, Hurlbut & Mauro, 1972). As a result of these observations, Okamoto *et al.* (1971) concluded that the pre-junctional site of the motor endplate was chiefly involved in the contractile response produced by exogenous ACh.

α-Bungarotoxin (α-BuTX) and β-bungarotoxin (β-BuTX) were isolated from the venom of *Bungarus multicinctus*, the former producing neuromuscular block of the antidepolarizing type by acting on the postjunctional membrane of the motor endplate, and the latter acting exclusively on the presynaptic side of the neuromuscular junction and producing a marked reduction in ACh output from the rat diaphragm and a blockade of neuromuscular transmission which was not associated with any diminution of response to ACh (Chang & Lee, 1963; Lee & Chang, 1966; Chang, Chen & Lee, 1973).

Since both black widow spider venom (BWSV) and β-BuTX were considered to block neuromuscular transmission presynaptically, it was deemed to be of interest to see whether β-BuTX has the same effect as BWSV on the contractile response to exogenous ACh in the cat gastrocnemius nerve muscle preparation *in situ*. In addition the effect of α-BuTX was compared on the same preparation.

Methods

Purification of bungarotoxins

α-Bungarotoxin and β-BuTX were isolated from the venom of *Bungarus multicinctus* by means of column chromatography on CM-Sephadex C-50 using ammonium acetate buffer gradient according to the method of Lee, Chang, Kau & Luh (1972). The concentration of buffer ranged from 0.05 M, pH 5.0 to 1.0 M. pH 6.8. Fractions 2 and 5, which contained α-BuTX and β-BuTX respectively, were rechromatographed on CM-cellulose with the same buffer system.

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Cat gastrocnemius-nerve muscle preparation

Cats of either sex (1.8–2.4 kg body weight) were anaesthetized with chloralose (80 mg per kg i.v.), the trachea was cannulated for artificial respiration (100 ml × 30 per min) and the left femoral vein for injection of drugs and toxins.

The gastrocnemius muscle preparation was prepared according to the method described by Brown, Dale & Feldberg (1936), except that the tension of the muscle was recorded with a Grass force displacement transducer FT 10C, which was connected with a direct writing Grass Model 7 Polygraph. ACh, dissolved in 0.1 ml 0.9% w/v NaCl solution (saline) was injected as rapidly as possible into the central end of the tibial artery for retrograde injection through the popliteal artery as described by Brown *et al.* (1936). The nerve to gastrocnemius muscle was placed on a pair of platinum electrodes for stimulation and all other branches of the sciatic nerve were sectioned. The stimuli were square wave pulses of 0.4 ms duration. Supramaximal single stimuli were delivered to the nerve at a frequency of 0.2 Hz. Atropine sulphate (1 mg per kg) was injected intravenously in order to prevent the lowering of blood pressure and other parasympathomimetic effects caused by ACh.

Results

An immediate muscle contraction was observed in response to intra-arterial ACh, exactly as described by Brown *et al.* (1936). Since the sensitivity of the gastrocnemius muscle to exogenous ACh might decrease after repeated intra-arterial injection of ACh, repeated test doses of ACh before administration of toxin were avoided. Instead, the response to ACh was tested only after neuromuscular transmission had been completely blocked by β-BuTX and the averaged ACh dose-response curve thus obtained on 8 cats was compared with that of a control group of 6 cats injected with saline.

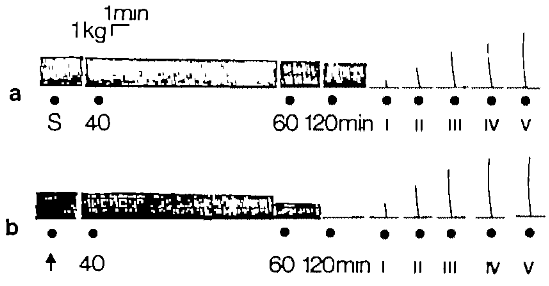

Figure 1 Contractions of the cat gastrocnemius muscle *in situ*. Supramaximal indirect stimulation of 0.4 ms duration was applied at a rate of 12 per minute Electrical stimulation was interrupted during close intra-arterial injection of acetylcholine (ACh). (a) Control, At S, saline was injected intravenously. (b) β-Bungarotoxin-poisoned muscle. At arrow, β-bungarotoxin (0.5 mg per kg i.v.) was injected. At i, ii, iii, iv and v, indirect stimulation was stopped and ACh 3, 10, 30, 100 and 300 μg, each dose dissolved in 0 1 ml saline, was injected (i a.) respectively

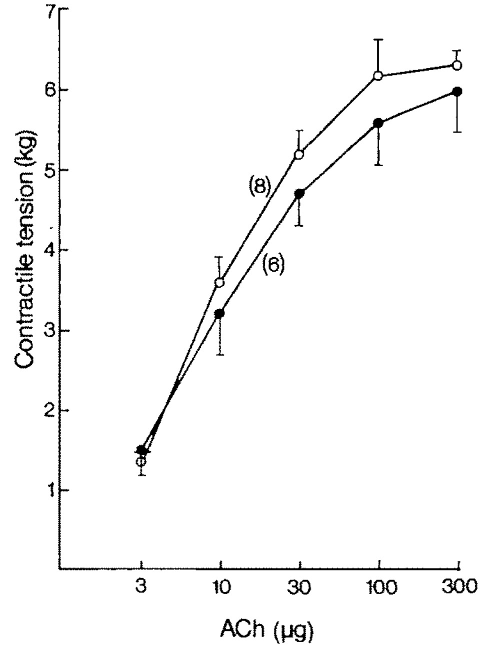

Figure 2 Dose-response curves to exogenous acetylcholine (ACh) in the cat gastrocnemius muscle Vertical lines represent standard error of mean. Number of experiments is indicated on the figure (●) Saline-injected control group; (○) β-bungarotoxin-injected group

When β-BuTX was injected intravenously into the cat at a dose of 0.5 mg per kg, the twitch resulting from single indirect stimulation began to decline about 40 min after injection and complete block occurred in 120.2 ± 5.05 min (mean ± s.e., $n = 8$). After neuromuscular transmission was completely blocked, the responses to different doses of ACh were examined (Figure 1b). In the saline-injected cats (control group), a dose-response analysis of ACh was made similarly after the sciatic nerve was stimulated for about 120 min (Figure 1a). No appreciable difference was observed between the ACh dose-response curve in the β-BuTX-treated cats and that in the saline-injected group (Figure 2). On the other hand, in the α-BuTX (1 mg per kg, i.v.)-treated cats, the gastrocnemius muscle contraction produced by ACh was progressively depressed before the decline of the response to indirect stimulation and finally abolished within 60 min after the injection, whereas

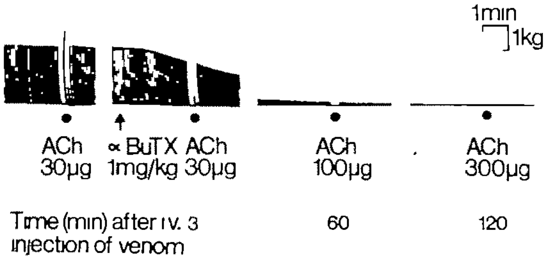

Figure 3 Effects of α-bungarotoxin (α-BuTX) on contractions of the cat gastrocnemius muscle *in situ.* Stimulation of the sciatic nerve (0.4 ms) once every 5 seconds. Electrical stimulation was interrupted during close intra-arterial injection of acetylcholine (ACh) At arrow, α-bungarotoxin was injected intravenously. At ACh, acetylcholine was injected intra-arterially.

complete neuromuscular block took place gradually in about 2 h (Figure 3).

Discussion

Although both BWSV and β-BuTX had been shown to block neuromuscular transmission presynaptically, their effects on the contractile response to exogenous ACh were quite different. According to Okamoto *et al.* (1971), the contractile response of both the cat gastrocnemius and the soleus muscle produced by exogenous ACh was severely impaired after complete poisoning with BWSV. The dose-response curve to intra-arterial ACh in the BWSV-treated cats was flattened and shifted to the right as compared to that of the control. As a result of these observations, they concluded that the prejunctional site of the motor endplate was chiefly involved in the contractile response produced by exogenous ACh. However, in the present experiments, the ACh dose-response curve in the β-BuTX-poisoned muscle was not appreciably different from that of the control, whereas the response to ACh was completely abolished by α-BuTX. Our results are in good accordance with the previous finding that β-BuTX does not affect the ACh receptor of the post-synaptic membrane (Chang & Lee, 1963; Lee & Chang, 1966; Chang *et al.*, 1973). Our results strongly indicate that the post-junctional site of the motor endplate is chiefly involved in the contractile response produced by exogenous ACh.

There are two possibilities for the discrepancy between our results and those of Okamoto *et al.* (1971): (1) BWSV might contain some component(s) that could affect post-synaptic membrane excitability to ACh, although Okamoto *et al.* (1971) claimed that BWSV was a toxin selectively poisoning the motor nerve ending. In this connection, Gruener (1973) has reported that BWSV can produce marked loss of excitability of the squid giant axon, whereas β-BuTX has no such action. (2) The sensitivity of the gastrocnemius muscle to exogenous ACh might have been reduced after repeated intra-arterial application of ACh in the experiments of Okamoto *et al.* (1971).

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STEREOSPECIFIC ACTIONS OF 2,5-DIMETHOXY-4-METHYLAMPHETAMINE (DOM) ON COLONIC TEMPERATURE IN THE RAT AT VARIOUS AMBIENT TEMPERATURES

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1 The R(–) and S(+)-isomers of 2,5-dimethoxy-4-methylamphetamine (DOM) produce a dose-dependent hypothermia in rats kept in the cold (6°C).

2 This hypothermia was linearly dependent upon ambient temperature and the R(–)-isomer was considerably more potent than the S(+)-isomer.

3 A statistically significant tachyphylaxis was observed when R(–)-DOM was administered on two successive days. The response seven days after the second injection was similar to that on the first day of injection.

4 The hypothermia induced by R(–) and S(+)-DOM was antagonized by methysergide but not by *p*-chlorophenylalanine (PCPA) or pimozide. Methysergide, PCPA or pimozide alone did not elicit hypothermia at the doses used. The results indicate that R(–) and S(+)-DOM act at post-synaptic 5-hydroxytryptamine receptors.

Introduction

Amphetamine causes a dose-dependent hyperthermia when administered parenterally to rats at room temperature (Morpugro & Theobald, 1965). In addition, Yehuda & Wurtman (1972a) have found that amphetamine causes hypothermia when given to rats placed in the cold (4–15°C). The hypothermic effect appears to be a result of an amphetamine-induced release of dopamine from brain neurones (Yehuda & Wurtman, 1972b). This conclusion was supported by the suppression of the amphetamine-induced hypothermia by drugs such as pimozide, which block dopamine receptors. In the case of amphetamine, the (+)-isomer is more potent than the (–)-isomer in the perturbation of body temperature or behaviour. In terms of absolute configuration, these isomers are known to exist as S(+) and R(–) (Schrecker & Hartwell, 1957). With regard to the hallucinogenic derivatives of amphetamine such as 2,5-dimethoxy-4-methylamphetamine (DOM), Benington, Morin, Beaton, Smythies & Bradley (1973) found that R(–)-DOM was much more potent than S(+)-DOM in disrupting conditioned avoidance in the rat. This reversal in stereospecificity between amphetamine and DOM strongly suggests a different mode of action. Furthermore, the most potent isomer of lysergic acid diethylamide (LSD) is (5R;8R)-(+)-LSD (Stadler & Hofmann, 1962). If in fact there is a common mode of action for these hallucinogens, then it is conceivable that the phenyl moiety of DOM could be congruent with the A ring of (5R;8R)-(+)-LSD and the α-carbon of DOM would equate with the C5 position of LSD at which location both molecules exhibit the R configuration. Kuhlemeier, Beaton & Bradley (1975) have observed that like amphetamine, DOM induces hypothermia in rats housed in the cold. However, R(–)-DOM was more potent than S(+)-DOM in contrast to the amphetamine-induced hypothermia where the R(–)-isomer is less potent than S(+). It therefore appears that the hallucinogenic effect and the hypothermia induced by DOM may share common mechanisms as indeed they share stereospecificity. In order to delineate further the relative potency of the DOM isomers and their mode of action, we have extended our investigation of the hypothermic effects of this hallucinogen.

Methods

Adult male brown hooded rats were used in all experiments. Colonic temperature was measured 5.5 to 6.0 cm past the anal sphincter with a copper-constantan thermocouple and a Model 112, Honeywell multipoint temperature recorder. All experiments were carried out in an environmental chamber maintained at 6 ± 1°C except the studies relating ambient temperature to responses to DOM when ambient temperatures were 10, 20 and 30°C. In

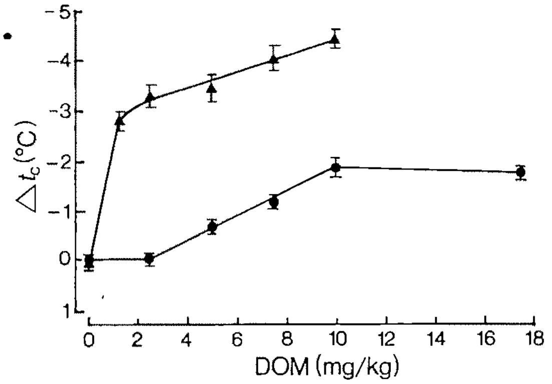

Figure 1 Dose-response curves showing the relation between change in colonic temperature (Δt_c) of rats after one hour in a cold (6 ± 1 °C) environment and various dosages of R(—)-2,5-dimethoxy-4-methylamphetamine (DOM) (▲) and S(+)-DOM (●). Points are means for 25 animals. Vertical lines show s.e. mean.

some experiments the rats were placed in cylindrical restraining cages during the experiments while in other experiments the animals were unrestrained in their usual cages. Colonic temperature was noted immediately before DOM administration and again after 1 h in the environmental chamber. All tests were carried out at the same time of day and at least one week was allowed between successive injections to the same animal except in the studies on tolerance.

Animals pretreated with *p*-chlorophenylalanine (PCPA, Regis Chemical Co., Morton Grove, Il) were given a first dose of 300 mg/kg (i.p.) 72 h before testing and a second and third dose of 100 mg/kg at 48 and at 24 h before testing. Pimozide, 8 mg/kg (s.c.) (kindly supplied by Dr. Paul Janssen) and methysergide, 1 or 2 mg/kg (s.c.) (Sandoz Pharmaceuticals, Hanover, NJ) were given to the rats 30 min before testing. DOM and methysergide were dissolved in sterile 0.9% w/v NaCl solution (saline) while PCPA and pimozide were suspended in sterile saline. DOM was injected subcutaneously. Colonic temperature measurements were made immediately before DOM administration and again after 60 min in the environmental chamber. The R(—) and S(+)-isomers of 2,5-dimethoxy-4-methylamphetamine hydrochloride were prepared as described by Nichols, Barfknecht, Rusterholz, Benington & Morin (1973). In most experiments the animals were placed in restraining cages but in the last experiments completed (see Table 1) and in later unpublished experiments unrestrained animals were used so that exposure periods longer than 1 h could be used if desired. Colonic temperatures of saline-treated restrained rats decrease continually for the duration of restraint.

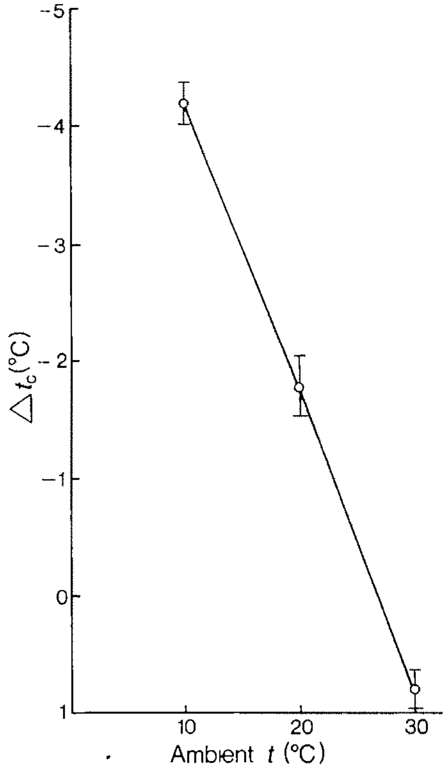

Figure 2 Relationship between ambient temperature and change in colonic temperature (Δt_c) of rats given 10 mg/kg of R(—)-2,5-dimethoxy-4-methylamphetamine (DOM) Points are means for 18 animals Vertical lines show s.e. mean

Results

Hypothermic effects of DOM isomers

The dose-response relationships between colonic temperature and the R(—) and S(+)-isomers of DOM at an environmental temperature of + 6°C are shown in Figure 1. The R(—)-isomer is clearly more potent than S(+). R(—)-DOM induced hypothermia when given at 1.25 mg/kg while S(+)-DOM had no effect at 2.5 mg/kg. S(+)-DOM at 17.5 mg/kg gave the same response as S(+)-DOM at 10 mg/kg. Doses of R(—)-DOM above 10 mg/kg were not given because it was feared that the resulting hypothermia might be fatal. The relation between ambient temperature and colonic temperature is illustrated in Figure 2 for a group of rats given 10 mg/kg R(—)-DOM. The equation of this line is $Y = 0.25\ X - 6.7$ where Y is colonic temperature change (corrected for saline control) in °C 1 h after the injection and X is the ambient temperature in °C. The hypothermia induced by R(—)-DOM is

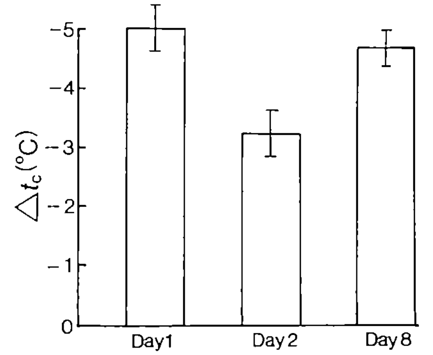

Figure 3 Mean and standard error of change in colonic temperature (Δt_c) of nine rats given 10 mg/kg R(—)-2,5-dimethoxy-4-methylamphetamine (DOM) and placed in a cold (6 ± 1 °C) environment for 1 h on successive days and again seven days after the second injection. Temperature measurements were made immediately before injection and placement in the environmental chamber and after 1 h in the chamber.

undoubtedly controlled by ambient temperature within this range. Slight hyperthermia is evident at 30°C.

Tachyphylactic effect on DOM administration

A tachyphylactic effect on the colonic temperature response was seen when R(—)-DOM (10 mg/kg) was given to the animals on two consecutive days as shown in Figure 3. The mean and standard error of the response on the first day was −5.02 ± 0.39°C; the response to the same dose given 24 h later was −3.22 ± 0.39°C, and the response seven days after the second injection was −4.65 ± 0.31°C. There was no significant difference between the response on the first day of this study and the response seven days after the second test day (paired t-test). However, the response on the second test day was significantly less ($P < 0.02$) than the response in the experiments conducted 24 h earlier.

Effect of pretreatment with pimozide, PCPA, and methysergide

The data are combined in Table 1. Neither pimozide nor PCPA pretreatment had a significant effect on the fall in colonic temperatures of rats subsequently given saline, R(—)- or S(+)-DOM. Pretreatment with methysergide at a dose of 2 mg/kg significantly ($P < 0.001$) reduced the hyperthermia. The responses to the R(—) and S(+)-isomers of DOM were equally affected by methysergide pretreatment when the effects of both isomers alone were equalized by giving 0.625 mg/kg R(—)-DOM and 8.75 mg/kg of S(+)-DOM. When the animals were given equimolar quantities of R(—)- and S(+)-DOM (10 mg/kg) and pretreated with 1 mg/kg methysergide the response to the R isomer was significantly reduced ($P < 0.05$) but the response to the S isomer was not significantly affected ($P > 0.05$).

Discussion

These results show that the temperature lowering effect of DOM seen in rats placed in the cold is stereospecific and that the R(—)-isomer is more effective than the S(+)-isomer. In contrast, the hypothermia induced by amphetamine is more pronounced after injection of the S(+)-isomer. Although amphetamine and DOM both produce hypothermia the reversal of stereospecificity suggests

Table 1 Effect of pimozide, *p*-chlorophenylalanine (PCPA) and methysergide on colonic temperature of rats given 2,5-dimethoxy-4-methylamphetamine (DOM) and placed in an environmental chamber maintained at 6 ± 1 °C for one hour

Pretreatment	*Treatment· Saline*	*R-DOM*	*S-DOM*	n
	Change in colonic temperature (Δt_c°C)			
Pimozide	−1.73 ± 0.27	−5.07 ± 0.35	−2.83 ± 0.30	15
PCPA	−1.49 ± 0.34	−4.66 ± 0.20	−2.36 ± 0.23	9
Methysergide 1 mg/kg	−0.49 ± 0.12	−2.83 ± 0.38	−1.06 ± 0.17	9
None	−1.53 ± 0.15	−5.36 ± 0.33	−3.02 ± 0.42	15
Methysergide 2 mg/kg	−0.05 ± 0.10	−0.25 ± 0.07	−0.61 ± 0.16	25
None	−0.29 ± 0.10	−1.20 ± 0.13	−1.29 ± 0.13	25

Rats pretreated with pimozide, PCPA and methysergide (1 mg/kg) were tested in restraining cages and given 10 mg/kg DOM or saline. Rats pretreated with methysergide (2 mg/kg) were given 0.625 mg/kg of R-DOM and 8.75 mg/kg of S-DOM and were unrestrained.

that the effect is produced by a different mechanism of action for each drug. The potency of R(–)-DOM in inducing hypothermia and in disrupting avoidance behaviour in the rat is higher than the potency of S(+)-DOM (Benington *et al.*, 1973). Snyder, Unger, Blatchley & Barfknecht (1974) have shown a higher potency of the R(–)-isomer of 2,5-dimethoxy-4-ethylamphetamine in the psychedelic activity in humans. The tachyphylaxis observed in DOM-induced hypothermia is similar to that reported for the effects of DOM on cat brain electrical activity (Wallach, Friedman & Gershon, 1972), for the increase in arterial blood pressure in the dog (Cheng, Long, Barfknecht & Nichols, 1973), and for hallucinogenic effects in man (Hollister, MacNicol & Gillespie, 1969). A detailed metabolic study with labelled DOM would be required in order to understand this development of behavioural and physiological tolerance. Wallach *et al.* (1972) have suggested that a metabolite of DOM might continue to act as an antagonist at the receptor involved. It is feasible that DOM itself might remain at the receptor or could induce a long term change in receptor function akin to desensitization or permanent depolarization. In the experiments described here, the DOM-induced hypothermia was effectively attenuated by methysergide but not by PCPA, as is also the case for the effect of DOM on the EEG in the cat (Wallach *et al.*, 1972). This finding implies that DOM-induced hypothermia may be due to a direct effect on post-synaptic 5-hydroxytryptamine receptors. Any action on dopamine receptors may be ruled out as the effect is not antagonized by pimozide. The 5-hydroxytryptamine-like effect of DOM may be related to its potency as an hallucinogen. Both effects are best achieved by the R(–)-isomer and may share a common site with (5R,8R)-(+)-LSD (Morin, Benington, Mitchell, Beaton, Bradley & Smythies, 1975) and other hallucinogenic indoles (Bradley & Johnston, 1970). The fact that hypothermia is induced in this way by a potent hallucinogen such as DOM may provide a reliable measure with which to explore both the mode of action of hallucinogenic drugs and the role of neurotransmitter systems in temperature regulation.

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THE EFFECTS OF MORPHINE ON THE RELEASE OF NORADRENALINE FROM THE MOUSE VAS DEFERENS

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1 Electrical field stimulation of the mouse vas deferens (TO and C57/BL strains) caused the release of noradrenaline into the bathing medium.

2 Phenoxybenzamine (30 μM) or phentolamine (36 μM) plus cocaine (13 μM) caused a considerable increase in the noradrenaline output.

3 In the vasa deferentia from TO mice the output per pulse of noradrenaline was constant at frequencies of stimulation from 0.5 to 15 Hz whereas in the vasa deferentia from C57/BL mice the output per pulse of noradrenaline increased two-fold from 1.5 to 15 Hz.

4 Morphine (2 μM) inhibited the contractions of the vasa deferentia from TO mice. This effect was greater at low (0.1–1 Hz) than at high (10 Hz) frequencies of stimulation. Morphine (2 μM) did not inhibit the response of the tissue to exogenous noradrenaline.

5 Morphine (1 μM) reduced the noradrenaline output from the vasa deferentia of TO mice stimulated at 1.5 Hz but did not reduce the noradrenaline output at 15 Hz. At 1.5 Hz the reduction of noradrenaline output was reversed by naloxone (0.05 μM).

6 Morphine (5 μM) did not inhibit the uptake of [^{3}H]-noradrenaline into the vasa deferentia from TO mice.

7 Only in high concentrations (ID_{50} 30.88 μM) did morphine inhibit the contractions of the vasa deferentia from C57/BL mice.

8 Normorphine (100 μM) did not reduce the noradrenaline output from vasa deferentia of C57/BL mice.

Introduction

Morphine and its cogeners have been shown to inhibit noradrenaline release in the cat nictitating membrane (Henderson, Hughes & Kosterlitz, 1975) and in the mouse vas deferens (Henderson, Hughes & Kosterlitz, 1972; Hughes, Kosterlitz & Leslie, 1975). In the cat nictitating membrane the output of noradrenaline is constant over the frequency range 0.2–15 Hz whereas at morphine-insensitive adrenergic junctions the output of noradrenaline increases as the frequency of nerve stimulation is increased (Hughes, 1972; Hughes & Roth, 1974; Henderson *et al.*, 1975). Similarly, the relationship between acetylcholine output and frequency of stimulation is different at morphine-sensitive and morphine-insensitive peripheral cholinergic junctions (Greenberg, Kosterlitz & Waterfield, 1970). Inhibition of noradrenaline release by narcotic analgesics has been demonstrated in rat cerebral cortex slices (Montel, Starke & Weber, 1974); in this preparation the noradrenaline output was greater at low (0.3 Hz) than at high (10 Hz) frequencies of stimulation. The purpose of this investigation was to determine whether the noradrenaline output from the mouse vas deferens shows a similar relationship with respect to stimulation frequency as that previously observed at other morphine-sensitive junctions.

A preliminary report of these results has been made to the British Pharmacological Society (Henderson & Hughes, 1975).

Methods

Mouse vas deferens

Two strains of mice were used; TO and C57/BL. Male mice weighing 25–35 g were killed by cervical dislocation; the vasa deferentia connected by a small portion of seminal vesicle were dissected out and placed in Krebs solution. The semen was gently expressed from the lumen and the tissue mounted vertically, under 0.5–1 g tension, in a 2.5 ml organ bath containing Krebs solution at 37°C. In those experiments in which the noradrenaline output from the vas deferens was measured, 4–6 pairs of vasa deferentia were mounted in a single organ bath.

Nerve stimulation

Electrical field stimulation was used to excite the intramural nerves. The cathode consisted of a ring of platinum foil (5 mm in depth) fixed to the top of the bath; the anode consisted of a fine coil of platinum wire inserted through the base of the bath. Supramaximal stimuli (1.3 x current required to produce the maximum mechanical response of the tissue) of 0.5–2 ms duration rectilinear pulses were used throughout. The contractions of the tissue to nerve stimulation were recorded isometrically and displayed on a pen oscillograph.

Determination of noradrenaline

The methods used to determine the tissue content of noradrenaline and the amount of noradrenaline released from the vas deferens by nerve stimulation were as described by Henderson *et al.* (1975). In several experiments the noradrenaline released from the vas deferens was estimated fluorimetrically by the method of O'Hanlon, Campuzano & Horvath (1970) without first being concentrated by alumina chromatography. No difference was observed between results obtained with or without alumina chromatography.

The vasa deferentia were stimulated at 15–30 min intervals with trains of 240 pulses. After nerve stimulation the fluid surrounding the vasa was left for 3 min (non-pretreated preparations) or 5 min (tissues pretreated with phenoxybenzamine or phentolamine plus cocaine) to permit the released noradrenaline to diffuse from the tissue into the surrounding bath fluid. The values for noradrenaline output after nerve stimulation have been corrected for the spontaneous output of noradrenaline during the collection period. Experiments in which the stimulated output of noradrenaline from the tissues declined by more than 10% per stimulus train were rejected. In any one experiment the output of noradrenaline at a single frequency is the mean of at least two observations. As described previously (Henderson *et al.*, 1975) electrical field stimulation did not produce any destruction of noradrenaline added to the organ bath.

Determination of [^{3}H]-noradrenaline uptake

Vasa deferentia were incubated at 37°C in Krebs solution containing 0.059 µM [^{3}H]-noradrenaline (specific activity 6.76 Ci/mmol) for various periods of time. After incubation, surface moisture was removed, the tissues homogenized and the noradrenaline extracted and purified as described by Henderson *et al.* (1975). The purified noradrenaline was added to 20 ml scintillation fluid. All samples were counted in a Packard Liquid Scintillation Counter for 10 min, with a counting efficiency 20–25%.

Drugs and solutions

The bathing fluid was a modified Krebs solution of the following composition (mM): NaCl 118, KCl 4.75, $CaCl_2$ 2.54, $MgSO_4$ 1.19, $NaHCO_3$ 24, KH_2PO_4 0.93, glucose 11, tyrosine 0.25, ascorbic acid 0.1 and disodium edetate 0.027; it was bubbled with 95% O_2 plus 5% CO_2.

Table 1 Fractional noradrenaline output per pulse from the mouse vas deferens due to stimulation at 0.5, 1.5 or 15 Hz with trains of 240 pulses

Treatment	*Fractional noradrenaline release per pulse ($\times 10^5$) at* 0.5 Hz	1.5 Hz	15 Hz	
(a) TO mice				
(i) None	0.83 ± 0.16	0.66 ± 0.13	0.71 ± 0.15	
(ii) Phenoxybenzamine, 30 µM	6.47 ± 0.62	7.73 ± 0.97	9.16 ± 0.94	
(iii) Phentolamine, 36 µM plus cocaine, 13 µM		4.83 ± 0.86	5.62 ± 0.91	
(b) C57/BL mice				
Phentolamine, 36 µM plus cocaine, 13 µM		1.78 ± 0.26	3.65 ± 0.76	($P < 0.0125$)

The tissues were incubated with drug solutions for 1 h before stimulation. The noradrenaline outputs from untreated and phenoxybenzamine-treated tissues were measured by biological assay, the noradrenaline outputs from phentolamine and cocaine-treated tissues were measured by fluorimetric assay. The values are the means ± s.e. of 4 experiments.

The drugs used were cocaine hydrochloride (Paterson), morphine hydrochloride (Macfarlan Smith), naloxone hydrochloride (Endo Laboratories), (—)-noradrenaline bitartrate (BDH), normorphine hydrochloride (Dr E. L. May), phenoxybenzamine hydrochloride (Smith, Kline & French) and phentolamine hydrochloride (Ciba). A conventional dioxane-toluene scintillation fluid was used.

Results

Noradrenaline output

(a) TO mice. The noradrenaline content of the vas deferens was 4.95 ± 0.39 µg/g tissue ($n = 11$). After stimulation with trains of 240 pulses, the fractional noradrenaline output per pulse from the untreated vasa deferentia was not significantly different at 0.5, 1.5 and 15 Hz (Table 1). The noradrenaline output from tissues incubated with phenoxybenzamine (30 µM) for 1 h was between 8 and 13-fold greater than that from untreated preparations (Table 1). After phenoxybenzamine the noradrenaline output was slightly higher at 15 Hz than at 0.5 Hz. In tissues which had been incubated with phentolamine (36 µM) plus cocaine (13 µM) for 1 h there was no significant increase in the noradrenaline output per pulse between 1.5 and 15 Hz (Table 1).

(b) C57/BL mice. The noradrenaline content of the vas deferens was 4.36 ± 0.16 µg/g tissue ($n = 8$). In the vasa deferentia of this strain of mice the noradrenaline frequency output relationship after stimulation with trains of 240 pulses at 1.5 and 15 Hz was different from that observed in the vas deferens from TO mice. After exposure of the vas deferens from C57/BL mice to phentolamine (36 µM) plus cocaine (13 µM) for 1 h the fractional noradrenaline output per pulse at 15 Hz was twice that at 1.5 Hz (Table 1).

Effect of morphine on contractions of the vas deferens

(a) TO mice. The contractions of the vas deferens from this strain of mice due to stimulation at 0.1 Hz were inhibited by morphine in a dose-dependent manner (Figure 1). As previously described, the minimum concentration of morphine required to inhibit the contraction at 0.1 Hz was 0.05 µM; 50% of the total contraction was inhibited by 0.47 ± 0.03 µM; concentrations of morphine greater than 5 µM produced a maximum inhibition of the contraction (Henderson *et al.*, 1972). In all preparations tested, normorphine was equiactive with morphine in depressing the contraction. The inhibition of contraction produced by morphine was completely reversible by naloxone. Naloxone (0.3–0.9 µM) did not itself alter the contractions of the vas deferens.

A comparison of the effects of a single concentration of morphine (2 µM) on the responses due to stimulation at various frequencies showed that morphine produces a greater inhibition of the contractions at low (0.1–1 Hz) than at high (10 Hz) frequencies of stimulation (Figure 2a, $n = 3$). Morphine (2 µM) did not alter the response of the vas deferens to exogenous noradrenaline whereas the response to

Table 2 Fractional noradrenaline output per pulse from the mouse vas deferens due to stimulation at 1.5 and 15 Hz with trains of 240 pulses before and after exposure to morphine and naloxone

	Fractional noradrenaline release per pulse ($\times 10^5$) at		
Treatment	*1.5 Hz*		*15 Hz*
(a) TO mice			
(i) None	1.72 ± 0.27 (5)	$P < 0.01$	1.66 ± 0.21 (4)
Morphine, 1 µM	0.77 ± 0.15 (5)	$P < 0.025$	1.37 ± 0.12 (4)
Morphine, 1 µM plus naloxone, 0.05 µM	1.49 ± 0.15 (5)		1.46 ± 0.20 (4)
(ii) None	1.84 ± 0.22 (4)		1.80 ± 0.31 (4)
Naloxone, 0.05 µM	1.83 ± 0.33 (4)		1.78 ± 0.12 (4)
(b) C57/BL mice			
None	4.95 ± 0.76 (4)		
Normorphine, 100 µM	3.24 ± 0.70 (4)		

All tissues were pretreated with phentolamine 36 µM plus cocaine 13 µM for 1 hour. The tissues were exposed to morphine for 6 min and to naloxone for 20 min before stimulation. The noradrenaline outputs were assayed fluorimetrically. The results were obtained from paired observations. The values are the means ± s.e., the numbers in parentheses are the number of observations. Fractional noradrenaline output per pulse is the output as a fraction of the total tissue content of noradrenaline after completion of the experiment.

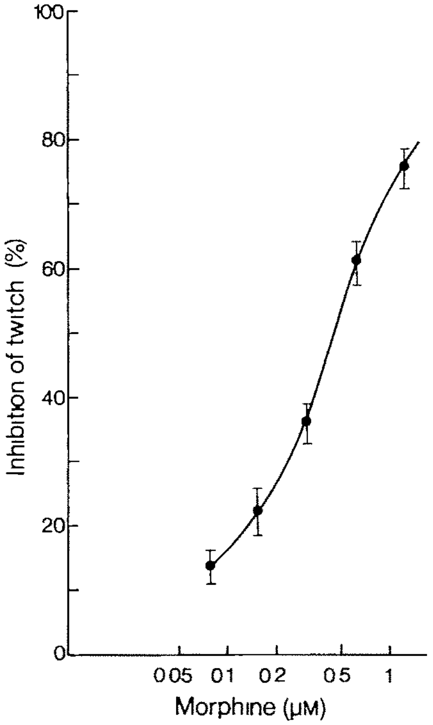

Figure 1 Effect of morphine on contractions of the mouse (TO) vas deferens stimulated continuously at 0.1 Hz Mean results from 6 experiments. Vertical lines show s.e. mean Ordinate scale: Inhibition of twitch as a percentage of the initial response Abscissa scale: morphine concentration.

electrical stimulation (0.1 Hz) was depressed by 75–85% (Figure 2b, $n=3$).

(b) C57/BL mice. The contractions due to stimulation at 0.1 Hz of the vas deferens from this strain of mice were not inhibited by morphine or normorphine until concentrations of 3–10 μM were used. Attempts were made to construct dose-response curves for morphine against contractions at 0.1 Hz but in only 4 out of 10 experiments was the maximum inhibition obtained greater than 50% of the initial contraction. In these 4 experiments the concentration of morphine required to produce 50% inhibition of the initial contraction ranged from 12–47 μM with a mean of 30.88 ± 9.47 μM. Naloxone (2.5 μM) completely reversed the inhibition of contraction produced by normorphine (50 μM, $n=4$, Figure 3). This concentration of naloxone did not alter the response of the vas deferens to electrical field stimulation or to exogenous noradrenaline.

Effect of morphine on the noradrenaline output from the vas deferens

Since there was considerable variation in the noradrenaline outputs of different preparations, these results were obtained from paired observations.

(a) TO mice. Exposure of the vas deferens to morphine (1 μM) for 6 min before stimulation resulted in a 55% depression of the fractional noradrenaline output per pulse at 1.5 Hz (Table 2). The fractional noradrenaline output per pulse at 15 Hz was not

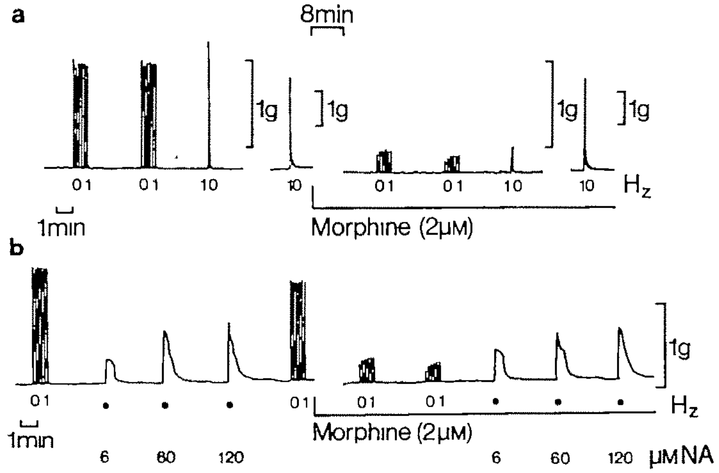

Figure 2 Effect of morphine on the responses of the mouse (TO) vas deferens to nerve stimulation or to exogenous noradrenaline (a) The effect of morphine on the response to nerve stimulation was greater at low (0.1–1 Hz) than at high (10 Hz) frequencies, (b) Morphine did not alter the response to exogenous noradrenaline (NA) whereas the response to nerve stimulation was inhibited

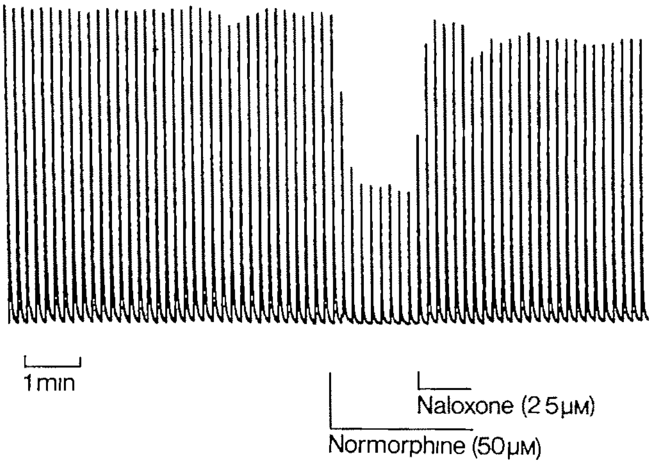

Figure 3 Effect of normorphine on the responses of the mouse (C57/BL) vas deferens to nerve stimulation at 0.1 Hz. Naloxone reversed the inhibition produced by normorphine.

significantly altered (Table 2). The depression by morphine of the noradrenaline output at 1.5 Hz was prevented by pretreatment of the tissue with naloxone (0.05 µM) for 20 min whereas naloxone (0.05 µM) itself did not alter the noradrenaline output from the vas deferens (Table 2).

(b) C57/BL mice. Exposure of the vas deferens to normorphine (100 µM) for 6 min prior to stimulation did not significantly alter the noradrenaline output at 1.5 Hz (Table 2).

Effect of morphine on [^{3}H]-noradrenaline uptake

Vasa deferentia from TO mice were incubated in Krebs solution containing [^{3}H]-noradrenaline (0.059 µM) for 0, 2 and 5 min; the [^{3}H]-noradrenaline was actively taken up and concentrated in the tissue. There was no difference at 2 and 5 min between the [^{3}H]-noradrenaline uptake into tissues incubated with [^{3}H]-noradrenaline alone and tissues incubated with [^{3}H]-noradrenaline plus morphine (5 µM) (Table 3).

Discussion

We believe that the motor innervation of the mouse vas deferens is adrenergic and that morphine acts by inhibiting the release of noradrenaline from the motor nerve terminals. The adrenergic nature of the innervation has been questioned (Ambache & Zar, 1971; Jenkins, Marshall & Nasmyth, 1975) and it is true that the vasa deferentia of several species exhibit anomalous pharmacological responses, particularly in respect of α-adrenoceptor blocking agents. We attribute these anomalous responses to the dense nature of the adrenergic innervation and in particular to the very close apposition of nerve endings and smooth muscle cells in this type of tissue (Lane & Rhodin, 1964; Yamauchi & Burnstock, 1969; Furness & Iwayama, 1971). The evidence in favour of adrenergic motor transmission is considerable; thus bretylium (Hughes, 1972), lysergic acid diethylamide (Hughes, 1973), and morphine (Henderson *et al.*, 1972; Hughes *et al.*, 1975) all inhibit noradrenaline release in the vas deferens by different mechanisms and also inhibit contractions of the tissue to nerve

Table 3 Effect of morphine on [^{3}H]-noradrenaline uptake into the mouse (TO) vas deferens

	[^{3}H]-noradrenaline uptake (d min^{-1} g^{-1} tissue × 10^4) at	
Treatment	*2 min*	*5 min*
None	68.6 ± 2.1	99.9 ± 3.6
Morphine, 5 µM	63.9 ± 4.7	102.3 ± 9.0

Tissues were incubated with [^{3}H]-noradrenaline, 0.059 µM (specific activity 6.76 Ci/mmol). The values are the means ± s.e. of 3 observations.

stimulation. Also, it has been shown that in the mouse vas deferens both guanethidine and 6-hydroxydopamine block motor responses to nerve stimulation (Furness, Campbell, Gillard, Malmfors, Cobb & Burnstock, 1970; Jones & Spriggs, 1975).

There is no evidence for the presence of ganglion synapses within the smooth muscle of the vas deferens or for a cholinergic component in the release of noradrenaline. The contractions and noradrenaline output of the vas deferens are unaffected by exposure of the tissue to hexamethonium (490 µM), hyoscine (0.23 µM) or eserine (7.7 µM) (Henderson *et al.*, 1972; Henderson, 1974). Thus, since morphine inhibits the response to nerve stimulation but not the response to exogenous noradrenaline the site of action of morphine must be on the postganglionic sympathetic nerve fibre to inhibit directly the release of noradrenaline as in the cat nictitating membrane (Henderson *et al.*, 1975). Intracellular recording from the smooth muscle of the mouse vas deferens during nerve stimulation has demonstrated the presynaptic site of action of morphine (North & Henderson, 1975; Henderson & North, 1976).

Using similar experimental procedures the characteristics of noradrenaline release have been examined from two tissues in which the noradrenaline output is inhibited by morphine, i.e. the mouse (TO) vas deferens (this paper) and cat nictitating membrane (Henderson *et al.*, 1975), and from four tissues in which the noradrenaline output is not inhibited by morphine, i.e. mouse (C57/BL) vas deferens (this paper), guinea-pig ileum myenteric plexus-longitudinal muscle preparation (Henderson *et al.*, 1975), rabbit portal vein and vas deferens (Hughes, 1972; Hughes & Roth, 1974). Within each group the characteristics of noradrenaline release are very similar. In the morphine-sensitive tissues the fractional noradrenaline output per pulse is constant over a wide range of frequencies (0.2–15 Hz for the nictitating membrane and 0.5–15 Hz for the vas deferens). In these tissues, inhibition of neuronal and extraneuronal noradrenaline uptake and inhibition of pre- and post-junctional α-adrenoceptors by phenoxybenzamine or phentolamine plus cocaine increased the noradrenaline output at each frequency of stimulation but did not greatly alter the relationship between noradrenaline output and frequency of stimulation. Therefore this relationship appears to reflect directly the properties of the noradrenaline release process. In the mouse (C57/BL) vas deferens, as in the other morphine-insensitive tissues, the noradrenaline output is not constant over a range of frequencies but increases as the frequency of stimulation is increased. In morphine-insensitive tissues the output of noradrenaline per pulse may increase as much as 10-fold between 0.5 and 16 Hz (Hughes & Roth, 1974).

In the adrenergic system the major difference between morphine-sensitive and morphine-insensitive tissues is the relatively high noradrenaline output at low (< 1 Hz) frequencies of stimulation observed in morphine-sensitive tissues. A similar relationship between morphine sensitivity and a high transmitter output at low frequencies of stimulation has been observed in the cholinergic system (Greenberg *et al.*, 1970; Lees, Kosterlitz & Waterfield, 1972). It may be significant that in all morphine-sensitive tissues morphine has its greatest effect at low frequencies of stimulation.

It remains to be seen whether there is a causal relationship between the existence of functional opiate receptors and the frequency-output relationship of a particular neuronal system. Enkephalin, an endogenous ligand for opiate receptor sites (Hughes, 1975; Hughes, Smith, Morgan & Fothergill, 1975) also inhibits noradrenaline and acetylcholine release (Hughes, Kosterlitz & Waterfield, unpublished results) and is present in the guinea-pig ileum where it may have a functional role (Waterfield & Kosterlitz, 1975). It remains to be seen if enkephalin is present at other morphine-sensitive sites and thereby modulates neurotransmitter release.

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THE POSSIBLE INVOLVEMENT OF Na^+ IONS IN CORTICOSTERONE-INDUCED HYPERCONTRACTILITY IN THE RAT ANOCOCCYGEUS MUSCLE

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1 The possibility that corticosterone-induced hypercontractility in the rat anococcygeus muscle might be due to an intramuscular redistribution of Na^+ was investigated.

2 The contractility of the isolated muscle to noradrenaline (NA) was directly dependent on the Na^+ concentration of the Krebs solution.

3 There was a linear relationship between the maximum contractile response of the muscle to NA and the Na^+ concentration of the Krebs solution.

4 Muscle contractility was also increased by the presence of ouabain (10^{-4}M) in the bathing medium.

5 Muscles from rats treated with corticosterone exhibited increases in both total and ouabain-sensitive ATPase activity.

6 The relationship between corticosterone, Na^+ distribution, and muscle contractility is discussed.

Introduction

Administration of corticosterone to rats produces two distinct changes in the sensitivity of the isolated anococcygeus muscle to agonists (Gibson & Pollock, 1975a). These changes are (i) a specific increase in the pD_2 value for acetylcholine (ACh) and (ii) a non-specific increase in the maximum contractile response of the muscle to both ACh and noradrenaline (NA).

The former change appears to result from the steroid-induced reduction in muscle cholinesterase activity (Gibson & Pollock, 1975b), thus explaining the specific increase in sensitivity to ACh. However, the second effect, on muscle contractility is as yet unexplained, and in this paper a possible explanation is presented.

Adrenocorticoids are known to influence electrolyte balance in many tissues (Beck & McGarry, 1962) and glucocorticoids in particular may act to modulate ionic distribution between the intra- and extra-cellular spaces (Brodie, Davies, Hynie, Krishna & Weiss, 1966). In this way the hormones are thought to regulate the responsiveness of the tissue to agonists (Swingle, Da Vanzo, Glenister, Wagle, Osborne & Rowen, 1960). Indeed, the potentiating effects of corticosteroids on vascular reactivity to catecholamines appear to involve an intramuscular redistribution of Na^+ ions (Raab, Humphreys, Makous, De Grandpre & Gigee, 1952; Ross, 1961; Selye, Hall & Rowley, 1943). It seemed possible therefore that Na^+ ions might also be involved in corticosterone-induced hypercontractility in the anococcygeus muscle. In an attempt to test this hypothesis, the following questions were posed. (1) Does variation of the Na^+ content of the Krebs solution affect muscle contractility to NA? (2) Does ouabain, a drug which modifies Na^+ movements by inhibiting the 'Na^+ pump' (Skou, 1965), affect muscle contractility? (3) Does corticosterone administration influence Na/K ATPase activity in the anococcygeus muscle?

Methods

Muscle sensitivity

Animals were killed by stunning and exsanguination. The anococcygeus muscles were dissected by the method of Gillespie (1972).

Isolated muscles were placed in organ baths containing 20 ml Krebs solution (mM: NaCl, 118.1; KCl, 4.7; $MgSO_4$, 1.0; KH_2PO_4, 1.2; $CaCl_2$, 2.5; Na HCO_3, 25.0; glucose, 11.1) which was maintained at 37°C and gassed continuously with 95% O_2 and 5% CO_2.

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A resting tension of 0.2–0.5 g was placed on the muscle and changes in tension were recorded by a Grass FTO3 force-displacement transducer attached to either a Grass Polygraph or a Devices M2 pen-recorder.

Drugs were added to the bath using a calibrated glass syringe in volumes not exceeding 0.4 ml, and were removed by drainage. Responses were measured as the peak rise in tension produced by any dose of agonist, and subsequent doses were not added until the muscle had returned to its resting tension.

The Na^+ content of the Krebs solution was altered by varying the amount of NaCl. When the Na^+ concentration was reduced appropriate amounts of LiCl were substituted to maintain the tonicity of the solution. However, no compensation was made when the Krebs solution contained excess Na^+ and consequently these solutions were hypertonic.

Ouabain was added to the bath immediately after completion of a control dose-response curve to NA. The effect of ouabain on muscle sensitivity was determined by completion of a second dose-response curve to NA 2 h later. Responses in both curves were calculated as a percentage of the original maximum response.

Assay of adenosinetriphosphatase (ATPase)

Rats were killed by stunning and exsanguination. Both anococcygeus muscles were quickly removed and homogenized in 2 ml sucrose (0.25 M; 0°C) using a ground-glass homogenizer (Jencons; 3 ml) with an electrically-driven glass pestle. ATPase activity was determined by a modification of the method of Hosie (1965).

Reaction tubes were prepared which contained in a volume of 1 ml: NaCl (150 mM); KCl (30 mM); $MgCl_2$ (4 mM); tris-buffer pH = 7.4 (100 mM); and homogenate (20 µl). Ouabain (150 µM) was added to duplicate tubes to inhibit Na^+/K^+ ATPase.

After preincubation at 37°C for 5 min the reaction was started by addition of tris-ATP (3 mM) and terminated after 15 min by 250 µl 25% TCA. To correct for non-enzymatic breakdown of ATP triplicate tubes were treated with TCA prior to addition of ATP.

Inorganic phosphate released from ATP during incubation was then assayed (Fiske & Subarrow, 1925).

The protein content of the homogenate was determined by the method of Lowry, Rosebrough, Farr & Randall (1951).

ATPase activity was calculated as µmoles Pi released/15 min per mg protein.

Animal pretreatment

Corticosterone (10 mg/kg; 5 days; i.p.) was administered as a suspension in ethyl oleate. Control rats received only ethyl oleate.

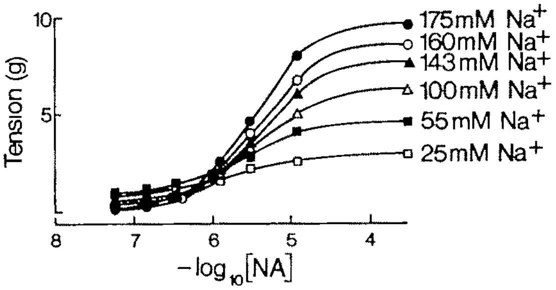

Figure 1 The effect of Na^+ concentration of the Krebs solution on the dose-response curve of the isolated anococcygeus muscle to NA. The s.e. mean values have been omitted to improve clarity, but each point is the mean of at least 6 observations.

Drugs used

Corticosterone (Sigma); ouabain (B.D.H.); noradrenaline bitartrate (Koch-Light).

Results

Effect of varying the Na^+ content of Krebs solution on muscle sensitivity to NA

Variation of the Na^+ content of the Krebs solution over a wide range had little effect on the resting tension of the anococcygeus muscle. However, on reduction of Na^+ to 25 mM the muscle displayed a slow, maintained rise in baseline tension, although this effect could be overcome by repeatedly washing the muscle with fresh bathing solution.

The effect of varying the Na^+ content of the Krebs solution on the dose-response curve to NA is shown in Figure 1. The responses of the muscle to lower doses of NA were little affected by Na^+ variation, but those to high doses (> 2 µM) were markedly dependent on the Na^+ concentration of the bathing medium. Examination of the maximum contractile responses (300 µM NA) revealed a linear relationship ($r = 0.81$; $n = 60$; $P < 0.001$) between muscle contractility and the Na^+ concentrations studied (Figure 2). Indeed, the maximum response could be increased by raising the Na^+ concentration above 'normal' (143 mM).

Effect of ouabain on muscle sensitivity to NA

A second dose-response curve to NA obtained 2 h after completion of the first revealed that muscle sensitivity was unchanged in control conditions (Figure 3a). However, 2 h after addition of ouabain (10^{-4} M) to the bath, muscle sensitivity to NA was increased. The responses to all doses of NA were increased, including the maximum response (Figure 3b).

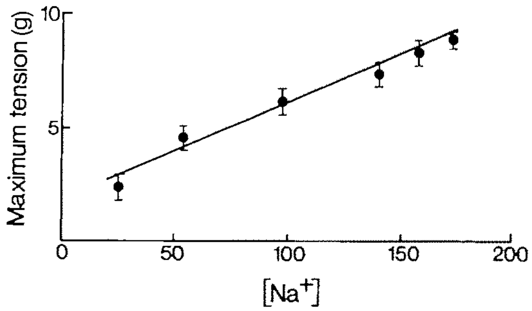

Figure 2 Relationship between maximum contractile response to NA and the Na^+ concentration of the Krebs solution. Each point is the mean of 10 observations and the vertical bars represent the s e mean. Regression analysis gives a correlation coefficient of 0.81 ($P<0.001$)

Effect of corticosterone on muscle ATPase activity

Administration of corticosterone for 5 days produced a 117% increase in the total ATPase activity of muscle homogenates (Table 1). The ouabain-sensitive fraction of the total ATPase activity was also increased, in this case by 96% (Table 1).

Discussion

The results obtained in the present study suggest that Na^+ ions are indeed important in determining the contractile capacity of the isolated anococcygeus muscle. Similar findings have also been reported for aortic strips (Yambayashi & Hamilton, 1959) and isolated myometrium (Marshall, 1964); Bulbring & Kuriyama (1963) found that the electrical and mechanical responses of guinea-pig taenia coli to ACh were greatly enhanced in media containing excess Na^+. Such results therefore support the possibility that Na^+ redistribution may be involved in the hypercontractility induced by corticosterone administration (Gibson & Pollock, 1975).

It is probable that the observed effects on muscle contractility were due to changes in intracellular rather than extracellular Na^+ concentrations. This is suggested by the ability of ouabain to increase muscle contractility to NA. Although ouabain has been shown to inhibit neuronal uptake of NA (Iversen, 1971), it is unlikely that this effect could explain the present results, since, in a previous study cocaine, which also inhibits neuronal uptake, produced a much greater supersensitivity in which the maximum contractile response was unaltered (Gibson & Pollock, 1973). Neither can the potentiation be due to inhibition of extraneuronal uptake of NA, since this mechanism does not appear to be of importance as a route of agonist inactivation in the anococcygeus muscle (Gibson & Pollock, 1973). It is more likely that the mechanism by which ouabain increases muscle contractility is similar to that proposed for the inotropic action of the glycoside on cardiac muscle. Thus, by inhibiting the 'sodium-pump' (Skou, 1965), ouabain produces an increase in intracellular Na^+ levels, which in turn increase the availability of Ca^{++} ions for contraction (Lee & Klaus, 1971; Godfraind, 1973). Further, raising the Na^+ content of the Krebs solution, which increased muscle contractility, would also result in raised intracellular Na^+ levels (Goodford, 1962; Casteels, Droogman & Hendrickx, 1973).

It is of interest that while ouabain potentiated the responses to all doses of NA, raising the Na^+ concentration affected only the responses to higher doses of the agonist. This probably reflects the rather severe effects of varying the ionic concentration over such a

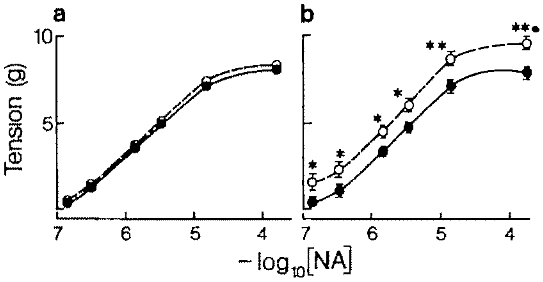

Figure 3 The effect of ouabain (10^{-4}M) on the dose-response curve to NA In (a) the broken curve (O) was obtained 2 h after completion of the first curve (●). In (b) the broken curve (O) was obtained after soaking the muscle in Krebs solution containing ouabain (10^{-4}M) for 2 hours Each point on the curves is the mean of 10 observations and the vertical bars represent the s e mean
* $0.05 > P > 0.01$; ** $P<0.001$.

Table 1 The effect of corticosterone administration on total and ouabain-sensitive ATPase activity in the anococcygeus muscle

	Total ATPase (µmoles P_i/15 min per mg protein)	*n*	*Ouabain-sensitive ATPase (µmoles P_i/15 min per mg protein)*
Control	2.49±0.19	40	0.46±0.08
Corticosterone	5.42±0.38†	28	0.91±0.14*

Values are given as mean ± s.e. mean, n=number of observations; * $0.01 > P > 0.001$; $P<0.001$.

wide range, compared with the more subtle effects of the glycoside on sodium movements.

Nevertheless, increased maximum responses are a rare feature of supersensitive smooth muscle (Fleming, McPhillips & Westfall, 1973) and the ability of both the above treatments to raise the maximum response to NA suggests that the similar effect produced by corticosterone administration may indeed be due to a redistribution of Na^+ ions within the anococcygeus muscle. In vascular smooth muscle, it has been postulated that a relationship exists between raised intracellular Na^+ levels and corticosteroid potentiation of responses to agonists (Raab *et al.*, 1952; Ross, 1961). Certainly the increased Na^+/K^+ ATPase activity observed in muscles from corticosterone treated rats, suggests that the hormone does affect Na^+ distribution within the muscle. However, at this point, an apparent contradiction arises, since although both ouabain and corticosterone raise muscle contractility, the former inhibits while the latter stimulates Na^+/K^+ ATPase activity. One possible explanation is that the hormone does not act directly on Na^+/K^+ ATPase, but rather facilitates entry of Na^+ ions into the cell, which in turn would stimulate the Na^+ pump. In support of this possibility, Sharp & Leaf (1966) have suggested that in the kidney, where corticosterone also stimulates ATPase activity (Chignell & Titus, 1966; Hendler, Torretti, Kupor & Epstein, 1972), the Na^+-retaining property of the corticosteroids is due to synthesis of a specific permease enzyme which increases membrane permeability to Na^+.

In conclusion, the preceding experiments point to a possible involvement of Na^+ ions in the production of corticosterone-induced hypercontractility in the anococcygeus muscle. However, the exact nature of this involvement and the mechanisms involved must await a detailed analysis of the effects of steroids on the movement of Na^+ and other ions between the intra- and extra-cellular spaces in passive and active muscle preparations.

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EFFECT OF IONOPHORE X-537A ON DESENSITIZATION RATE AND TENSION DEVELOPMENT IN POTASSIUM-DEPOLARIZED MUSCLE FIBRES

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1 The effects of the ionophore X-537A were studied on carbamylcholine (carbachol)-induced desensitization and on tension development in relaxed potassium-depolarized frog sartorius muscles.

2 X-537A accelerated carbachol-induced desensitization in Ca^{2+}-deficient solutions without having any effect on the conductance of the membrane in the absence of carbachol or on the extent of the carbachol-induced increase in conductance.

3 In Ca^{2+}-deficient solution, the acceleration of desensitization by the ionophore was concentration-dependent. No effect was observed with concentrations less than 5 µM and maximal acceleration was evident with 10 µM.

4 The influence of X-537A on desensitization was time-dependent. At 20 µM X-537A, there was a marked acceleration of desensitization by the end of 5 min exposure. An additional gradual acceleration occurred during a 5 to 30 min treatment. No acceleration of desensitization was evident when X-537A was simultaneously applied with carbachol to the end-plate region without prior exposure to the ionophore.

5 Desensitization also was accelerated by 30 min exposure to 20 µM X-537A in solutions containing Ca^{2+} or deficient in both Mg^{2+} and Ca^{2+}; the rate being increased 2.8-fold in Ca^{2+}-containing solutions, 2.9-fold in Ca^{2+}-deficient solutions containing Mg^{2+}, and 2.5-fold in divalent cation-deficient solutions.

6 Tension development gradually occurred in relaxed potassium-depolarized muscle preparations exposed to 20 µM X-537A. The onset of tension development occurred only after approximately 25 min of exposure both in preparations kept in Ca^{2+}-deficient or Ca^{2+}-containing solutions. By the end of 90 min in the ionophore, the tension developed was approximately 12% and 23% of the initial potassium contracture in those preparations maintained in the Ca^{2+}-deficient or Ca^{2+}-containing solutions, respectively.

7 We assume that the increase in desensitization rate following exposure to X-537A results from an elevation of the intracellular Ca^{2+} concentration. That muscle tension gradually increased during exposure to the ionophore supports this conclusion. The acceleration of desensitization by X-537A in the absence of external Ca^{2+} supports the view that the site of calcium acceleration is not on the external surface of the end-plate membrane either at or near the agonist-recognition site but rather on the inner surface.

Introduction

Application of carbachol activates end-plate receptors at the neuromuscular junction of skeletal muscle fibres producing a rapid increase in ionic conductance of the end-plate membrane. In the continued presence of agonist, the conductance gradually returns toward the pre-activation state as 'desensitization' occurs (Thesleff, 1955). Manthey (1966) has shown that raising the external calcium concentration accelerates the rate of carbamylcholine (carbachol)-induced desensitization. Although the site of calcium action in desensitization is not established, it has been suggested recently that this site is located on the internal surface of the postjunctional membrane and therefore is distinct from the agonist-recognition site on the external surface of this membrane (Nastuk & Parsons, 1970; Cochrane & Parsons, 1972; Parsons, Schnitzler & Cochrane, 1974). This view would be greatly strengthened by the demonstration that the rate of desensitization was accelerated by raising the level of intracellular ionized calcium in a muscle preparation maintained in a calcium-deficient solution.

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The most direct approach is to inject Ca^{2+} by electrically-controlled iontophoresis as has been done by Miledi (1973) and Kanno, Cochrane & Douglas (1973) to demonstrate that elevation of internal calcium initiates secretion. Our attempts to use this approach have been unsuccessful. Consequently, our desensitization experiments have concentrated on the influence of agents which increase the internal level of ionized calcium. In our initial studies, described in this paper, we used the ionophore, X-537A, which is thought to transport Ca^{2+} across the cell membrane as well as to mobilize cell Ca^{2+} from sarcoplasmic reticulum and mitochondria (Entman, Gillette, Wallick, Pressman & Schwartz, 1972; Scarpa & Inesi, 1972; Scarpa, Baldassare & Inesi, 1972; Pressman, 1972, 1973; Levy, Cohen & Inesi, 1973; Lin & Kun, 1973).

To test the hypothesis that the site of Ca^{2+} action in desensitization is located on the inner surface of the endplate membrane we have used the ability of X-537A to raise intracellular Ca^{2+} by mobilizing cell calcium even in the absence of external calcium. In addition, we have examined the influence of elevating internal Ca^{2+} by X-537A on development of tension in relaxed potassium-depolarized muscle preparations.

A preliminary account of some of these results has been published (Schnitzler, DeBassio & Parsons, 1975).

Methods

General methods

All experiments were performed *in vitro* on potassium-depolarized sartorius muscle preparations of the frog (*Rana pipiens*) at room temperature (18–20°C) during the period of November to May. The potassium-depolarized preparation was used because it eliminates the change in membrane potential and contraction associated with end-plate activation in polarized fibres. In addition, X-537A rapidly depolarizes muscle fibres maintained in normal sodium Ringer solution presumably because this agent transports monovalent as well as divalent cations (Pressman, 1973; Devore & Nastuk, 1975; Schnitzler & Parsons, unpublished observations). As desensitization rate is influenced both by membrane potential (Magazanik & Vyskocil, 1970) and by intracellular sodium (Manthey, 1966; Parsons *et al.*, 1974), other experimental conditions used previously to minimize muscle movement such as hypertonic Na-sucrose solutions were considered inappropriate for these studies.

Most of the experiments were done with muscles kept in a Ca^{2+}-deficient, isotonic potassium propionate solution (Solution C). A few other experiments were done in an isotonic potassium solution containing Ca^{2+} (Solution B) or in a solution devoid of both Ca^{2+} and Mg^{2+} (Solution D). The composition of these test solutions is summarized in Table 1. In the Ca^{2+}-deficient solution (Solution C) and in the divalent cation-deficient solution (Solution D), 1 mM ethylene-(oxyethylenenitrilo)-tetraacetic acid (EGTA) was added to facilitate the removal of residual calcium. Dimethylsulphoxide (DMSO), the solvent for the ionophore was included in all the isotonic potassium solutions at a final concentration of 0.5%. In all experiments the duration of DMSO exposure was kept at 30 min regardless of the ionophore exposure time. In preliminary experiments, we determined that 0.5% DMSO did not influence the extent of carbachol-induced activation or the rate of desensitization. The ionophore, X-537A, (Hoffman-La Roche Inc., Nutley, N.J.) was prepared as a stock solution in DMSO, diluted to a desired concentration, and introduced by adding it to the solution bathing the muscle and by microperfusing it along with carbachol at the junctional region of individual fibres.

Carbachol (1 mM) (Sigma Chemical Co., St. Louis, Mo.), an analogue of acetylcholine which is resistant to hydrolysis by acetylcholinesterase, was used to activate the postjunctional membrane receptors. The carbachol was microperfused from a 50–100 µm diameter pipette onto the end-plate region of an individual muscle fibre by hydrostatic pressure (Manthey, 1966; Johnson & Parsons, 1972). The junctional region of individual muscle fibres was

Table 1 Composition of Ringer solutions

*Solution**	*NaCl (mM)*	*KCl (mM)*	*K propionate (mM)*	*$CaCl_2$ (mM)*	*Ca propionate (mM)*	*$MgCl_2$ (mM)*	*EGTA (mM)*	*Tris (mM)*	*DMSO %*
A	120	2.5	—	1.8	—	—	—	1	—
B	—	—	122.5	1.3	0.5	2.0	—	1	0.5
C	—	—	122.5	—	—	2.0	1	1	0.5
D	—	—	122.5	—	—	—	1	1	0.5

* pH = 7.2–7.3

located visually by following nerve twigs to their termination under a magnification of 300× using a Bausch and Lomb dynoptic microscope with a Leitz long working distance objective (~1.2 cm). No more than one end-plate was used per muscle.

Standard electrophysiological recording techniques were used to measure the resting membrane potential and effective membrane conductance of individual muscle fibres (Nastuk & Parsons, 1970; Manthey, 1972). The micropipettes used in this study were filled with 3 M KCl and had resistances ranging from 5–8 MΩ.

Results are reported as mean values ± the standard error of the mean. Tests of significance between different treatment groups were made by the nonpaired Student's *t* test. Values of *P* less than 0.05 were regarded as significant.

Measurement of receptor activation and desensitization rate

The extent of end-plate activation was estimated from the increase in end-plate conductance produced by the local application of carbachol. For these experiments, the maximum acceptable rise time of activation was 4 s and minimum extent of conductance increase was 3-fold.

The time course of end-plate desensitization during sustained carbachol perfusion was estimated from the rate of decline of the effective membrane conductance, after the initial increase. The half-time of conductance return was used as an index of desensitization rate (Manthey, 1966; 1972). In all experiments when desensitization was complete the conductance returned to within 0.5 μmho of its pre-carbachol value.

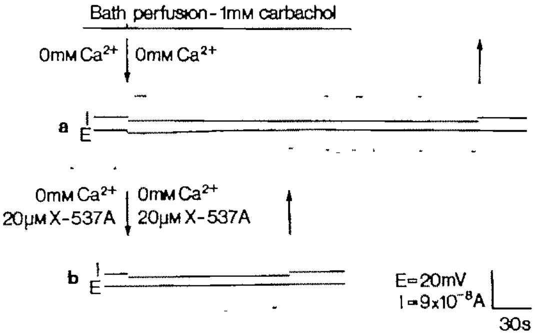

Figure 1 Effect of the ionophore X-537A on the time course of the carbachol-induced conductance change (a) Response from a control fibre maintained in the Ca^{2+}-deficient solution (Solution C) for 30 min before 1 mM carbachol perfusion (b) Response from another fibre exposed for 30 min to Solution C plus 20 μM X-537A In both examples, the dots above the I trace denote transient hyperpolarizing current pulses applied every other second. The dots below the E trace indicate the shift in membrane potential produced by the current pulses The arrows indicate the start and end of carbachol application. The breaks in example (a) indicate 1 min intervals when the recording camera was turned off. The half-time of desensitization was 63 s in (a) and 18 s in (b).

Measurement of tension development

Muscles were mounted vertically at rest length in a 30 ml chamber and equilibrated in Solution A for at least 30 min before exposure to either Solution B or C. Rest length was determined either *in vitro* from the length-tension relationship for indirectly elicited twitches or from a measurement of *in situ* rest length before dissection. During the initial moments of exposure to the isotonic potassium solution, muscles contracted and then relaxed (Hodgkin & Horowicz, 1960). The X-537A containing solution was added after the potassium contractions had subsided. Isometric tension development was measured by a Grass FT03 Strain gauge.

Results

Influence of X-537A on carbachol-induced desensitization

Effect in Ca^{2+}-deficient solutions. When muscle preparations maintained in the Ca^{2+}-deficient isotonic potassium propionate solution (Solution C) were exposed to 20 μM X-537A for 30 min, the rate of 1 mM carbachol-induced desensitization was increased. Ionophore treatment had no effect on the conductance of the end-plate membrane in the absence of carbachol nor on the extent of the carbachol-induced increase in conductance. A record which illustrates the acceleration of 1 mM carbachol-induced desensitization following treatment with 20 μM X-537A is shown in Figure 1. Example (a) is taken from a control muscle fibre equilibrated for 30 min in the Ca^{2+}-deficient, isotonic potassium propionate solution, containing 2.0 mM Mg^{2+} and 1 mM EGTA (Solution C). Application of carbachol, indicated by the first arrow, produced a rapid increase in input conductance which persisted for a brief period and then returned toward the pre-perfusion level even though the carbachol application continued until the second arrow. The half-time of conductance return, from the maximum value, was 63 s in this fibre. Example (b) is taken from a muscle treated for 30 min with Solution C containing 20 μM X-537A. In this case, the rate of conductance return is much faster; the half-time value being 18 s in this fibre. Results from many experiments following a 30 min treatment with 20 μM X-537A on fibre input conductance and rate of 1 mM carbamylcholine-induced desensitization in muscles

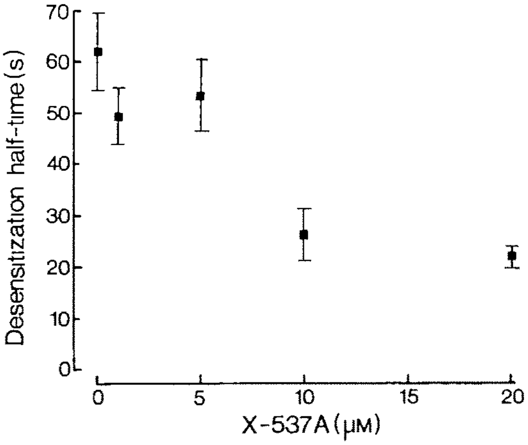

Figure 2 Influence of X-537A concentration on 1 mM carbachol desensitization half-time in muscles maintained in the Ca^{2+}-deficient solution (Solution C). The duration of ionophore exposure was 30 min for all concentrations. Each point represents mean of the half-time from at least 6 fibres. Vertical lines show s.e. mean.

maintained in the Ca^{2+}-deficient solution are summarized in Table 2.

The dose-response relationship between X-537A concentration and desensitization half-time for muscles maintained in the Ca^{2+}-deficient solution is shown in Figure 2. At all concentrations, the duration of ionophore exposure was 30 minutes. In low concentration (1 or 5 μM), the ionophore did not influence desensitization rate (Figure 2). However, in the presence of 10 μM X-537A, the rate of desensitization was significantly increased and doubling the ionophore concentration to 20 μM produced no additional acceleration of desensitization.

The time course of the acceleration of desensitization by ionophore treatment in muscles maintained in the Ca^{2+}-deficient solution is shown in Figure 3. For these experiments, the concentration of X-537A was kept at 20 μM and duration of ionophore exposure varied. In all instances, the DMSO exposure was 30 minutes. X-537A produced a marked acceleration of desensitization by the end of 5 min treatment. An additional gradual acceleration occurred during a 5 to 30 min treatment. The curve in Figure 3 is a computer fit to the data points and represents the sum of the two exponential expressions shown below,

$$T/2(t) = 21.6\, e^{-t/1.17} + 35\, e^{-t/58.1}$$

where t = minutes.

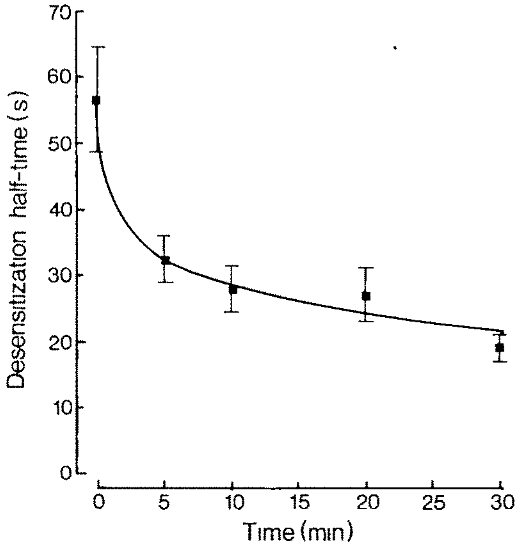

Figure 3 Time course of X-537A acceleration of 1 mM carbachol-induced desensitization. Muscles maintained in the Ca^{2+}-deficient solution (Solution C) and exposed to 20 μM X-537A for various periods of time. Exposure to 0.5% dimethylsulphoxide was 30 min in all experiments. Each point represents the mean value from at least 7 fibres. Vertical lines show s.e. mean. The curve was fitted using the equation,

$$T/2(t) = 21.6\, e^{-t/1.17} + 35\, e^{-t/58.1},$$

with t in minutes.

Table 2 Influence of 20 μM X-537A on fibre input conductance and rate of 1 mM carbachol-induced desensitization in muscles equilibrated in Ca^{2+}-free, 2 mM Mg^{2+}, 1 mM EGTA, K propionate solution

Condition	*Input conductance prior to carbachol (mho × 10^{-6})*	*Maximum input conductance during carbachol perfusion (mho × 10^{-6})*	*Desensitization half-time (s)*	*No. Fibres*
Control	4.4 ± 0.4*	17.2 ± 1.4	58.8 ± 5.5•	16
X-537A for 30 min	4.1 ± 0.4	15.9 ± 2.1	20.5 ± 1.4•	13

* Mean ± s.e. mean
• Significant $P < 0.05$

Caffeine, Ca^{2+}, and La^{3+} have been found to accelerate desensitization without equilibration prior to carbachol application (Manthey, 1970; Parsons, Johnson & Lambert, 1971; Cochrane & Parsons, 1972). In these instances, simultaneous perfusion of these agents with carbachol is sufficient to influence desensitization rate. Since most of the influence of X-537A treatment on desensitization occurs within the first 5 min, the question of an immediate effect of X-537A had to be investigated. However, the inclusion of the ionophore along with carbachol in the perfusion fluid without pre-equilibration did not influence the desensitization rate. In 10 fibres perfused with 1 mM carbachol alone, the half-time of conductance return was 56.8 ± 7.7 s whereas in 8 other fibres perfused simultaneously with 1 mM carbachol and 20 μM X-537A, the half-time of conductance return was 50.3 ± 5.5 seconds.

Effects in divalent cation deficient solution. X-537A is also an ionophore for Mg^{2+} (Pressman, 1972). Although Mg^{2+} is an ineffective substitute for Ca^{2+} in desensitization under other experimental conditions (Nastuk & Parsons, 1970; Parsons *et al.*, 1973), experiments were done to insure that the acceleration of desensitization by ionophore treatment was not related to Mg^{2+}. The influence of X-537A on desensitization was studied on muscles maintained in a divalent cation-deficient, potassium propionate solution containing 1 mM EGTA (Solution D).

Previously, Lambert & Parsons (1970) found that endplate activation by carbachol is reduced when no divalent cations are present. A reduced end-plate responsiveness to 1 mM carbachol also was observed in the present experiments regardless of whether the ionophore was present or not. A significant acceleration of desensitization was produced by 30 min treatment with 20 μM X-537A. In 8 fibres maintained in the divalent cation-deficient solution for 30 min, the half-time of 1 mM carbachol-induced desensitization was 82.3 ± 15.0 seconds. In another 8 fibres, following a 30 min exposure to 20 μM X-537A, the half-time of 1 mM carbachol-induced desensitization was 32.4 ± 4.6 seconds.

Effect in calcium containing solution. X-537A is thought to raise internal Ca^{2+} by transporting extracellular Ca^{2+} across the cell membrane as well as by mobilizing intracellular Ca^{2+}. (Entman *et al.*, 1972; Scarpa & Inesi, 1972; Scarpa *et al.*, 1972; Pressman, 1972; 1973; Levy *et al.*, 1973; Lin & Kun, 1973). Exposure to X-537A in the presence of external calcium should therefore accelerate desensitization to a greater extent than when no external calcium is present. Consequently, experiments were done in which muscles were maintained for 30 min either in Solution B or Solution B containing 20 μM X-537A before the application of 1 mM carbachol. In the presence of calcium, the rate of desensitization was faster for both the control and ionophore-treated fibres than in those respective fibres maintained in the Ca^{2+}-deficient solution (cf. Table 2). The half-time of desensitization was 44.3 ± 9.7 s for 6 fibres maintained in Solution B without ionophore and was 16.0 ± 0.8 s for 4 fibres exposed for 30 min to Solution B containing 20 μM X-537A. However, the increase in desensitization rate indicated by the ratio of control to test half-time values, was similar. The rate was increased 2.8-fold when Ca^{2+} was present (Solution B) and 2.9-fold when calcium was omitted (Solution C).

Effect of 20 μM X-537A on tension development in relaxed potassium-depolarized muscle preparations

It is generally believed that most of the pharmacological actions of X-537A are related to its ability to act as an ionophore for divalent or monovalent cations (See Cochrane, Douglas, Mouri & Nakazato, 1975). In the present study we assumed that the acceleration of desensitization was due to the ability of X-537A to increase the level of internal calcium. If this assumption is valid, then tension development should occur during X-537A treatment as the internal Ca^{2+} concentration rises. Consequently, experiments were undertaken to measure tension ouput from relaxed potassium-depolarized fibres exposed to 20 μM X-537A.

Both sartorii were utilized; one muscle served as a control and the other as a test preparation. All muscles initially were equilibrated for at least 30 min in a Tris-buffered sodium Ringer solution at rest length (Solution A). The muscles were then transferred to an isotonic potassium solution (either Solution B or C). The muscles contracted during the initial moments of exposure to the elevated potassium solution and then relaxed (Hodgkin & Horowicz, 1960). One muscle of the pair was maintained in the isotonic potassium propionate solution without ionophore (although 0.5% DMSO was present) for the duration of the experiment. The test muscle was transferred to the isotonic potassium propionate solution (either Solution B or C) containing 20 μM X-537A immediately after the potassium contracture had subsided. Three of these 'paired muscle' experiments were done in Solution B and Solution C, respectively. In the present study no attempt was made to quantitate these results in terms of tension development per cross sectional area or unit of muscle mass. The change in muscle tension with ionophore exposure was expressed as a percentage of the tension developed during the initial potassium contracture produced in an individual preparation.

No tension development occurred in the relaxed potassium-depolarized preparations exposed to 20 μM X-537A during an initial 25 min period. However, after 25–40 min in X-537A, muscle tension gradually increased. The onset of tension development was similar in muscles exposed to the ionophore in either the presence or absence of external calcium (Solution B or C, respectively). The first measurable increase in tension occurred at 26, 42 and 45 min in those preparations exposed to the ionophore in Solution B and at 25, 32 and 45 min in those preparations exposed to the ionophore in Solution C. By the end of a 90 min exposure to 20 μM X-537A (a time arbitrarily chosen to terminate these experiments) the tension had increased to 23 ± 9% and 12 ± 3% of the initial potassium contracture in the Ca^{2+}-containing (Solution B) or Ca^{2+}-deficient solution (Solution C), respectively. In the absence of the ionophore, muscle tension gradually declined in those preparations kept in Solution C so that by the end of 90 min the tension decreased by approximately 4%. No change in tension was noted after the initial contracture-relaxation cycle had occurred in those 3 preparations maintained in Solution B and not exposed to the ionophore.

Discussion

The results presented here show that exposure of potassium-depolarized muscles to X-537A (1) accelerated carbachol-induced desensitization without changing the extent of end-plate activation and (2) caused tension development in relaxed, potassium-depolarized muscles. These effects occurred in the presence or absence of external calcium and, we assume, reflect a gradual increase in the level of internal ionized calcium.

It has generally been accepted that most of the effects of X-537A are related to its ability to act as a Ca^{2+} ionophore (Pressman, 1972; 1973). We anticipated a more pronounced acceleration of desensitization and a more rapid onset of tension development when calcium was present in the bathing solution. This was not observed. X-537A releases calcium from sarcoplasmic reticulum (Entman *et al.*, 1972; Pressman, 1972; Scarpa & Inesi, 1972; Scarpa *et al.*, 1972; Levy *et al.*, 1973) and from mitochondria (Lin & Kun, 1973). That the magnitude of the change in desensitization rate and onset of tension development was similar in the presence and absence of external calcium suggests that the increase in internal Ca^{2+} concentration occurred primarily from the mobilization of cell calcium rather than from calcium transport across the sarcolemma. However, that the magnitude of tension development at 90 min was greater in Ca^{2+} solutions may indicate that some additional Ca^{2+} was transported by the ionophore.

The time course of 20 μM X-537A-induced change in desensitization rate is described by the sum of two exponential expressions; the first having a fast decay and the second a much longer time constant. Scarpa *et al.* (1972) and Levy *et al.* (1973) found that 20 μM X-537A produced an initial rapid release of Ca^{2+} from sarcoplasmic reticulum vesicles followed by a much slower phase of Ca^{2+} release. This complex time course of X-537A-induced change in desensitization half-time may be a reflection of these two phases of Ca^{2+} mobilization by the ionophore.

End-plate membrane activation by carbachol was not altered by X-537A exposure at a time when the rate of desensitization was markedly enhanced. It follows then that this amount of elevation of the internal Ca^{2+} concentration has no effect on the responsiveness of the agonist-recognition site or of any subsequent components in the permeability-activation system (cf. Lapa, Albuquerque & Daly, 1974) prior to carbachol activation.

We assumed that the increase in desensitization rate following exposure to X-537A resulted from an elevation of the intracellular Ca^{2+} concentration. That muscle tension gradually increased during exposure to the ionophore supports this conclusion. However, tension increased after a much longer delay suggesting that the change in internal Ca^{2+} concentration required to affect desensitization rate is less than that for the initiation of contraction. The concentration of Ca^{2+} in muscle at rest is ~0.1 μM with tension development occurring when the Ca^{2+} concentration exceeds ~ 1 μM (Godt, 1974). After 5 min in X-537A, the rate of desensitization was increased dramatically. With longer durations of exposure, the rate increased less markedly, suggesting the influence of the ionophore on desensitization was approaching some maximum effect by the end of 30 minutes. It appears then that when the internal Ca^{2+} concentration reaches ~1 μM and tension development begins, the Ca^{2+} effect on desensitization is almost complete. A limit to the influence of calcium on desensitization rate also has been observed under other conditions (Nastuk & Parsons, 1970; Cochrane & Parsons, 1972).

It was suggested that the site of Ca^{2+} action in desensitization is on the inner surface of the end-plate membrane (Nastuk & Parsons, 1970; Cochrane & Parsons, 1972). In the experiments described here, desensitization increased during exposure to X-537A in the absence of external calcium. This effect was not related to Mg^{2+} because ionophore exposure in a divalent cation-deficient solution also increased desensitization. The acceleration of desensitization during exposure to X-537A under these conditions supports the view that the site of calcium acceleration is not on the external surface of the end-plate membrane either at or near the agonist-recognition site but rather on the inner surface.

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PREVENTION BY ZINC OF CADMIUM-INDUCED ALTERATIONS IN PANCREATIC AND HEPATIC FUNCTIONS

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1 Subacute cadmium treatment ($CdCl_2$, 1 mg/kg twice daily for 7 days) in rats disturbs glucose homeostasis as shown by hyperglycemia and decreased glucose tolerance associated with suppression of insulin release, enhancement of hepatic gluconeogenic enzymes and decrease in hepatic glycogen content.

2 Exposure to cadmium increases hepatic cyclic adenosine 3′,5′-monophosphate (cyclic AMP) and this is accompanied by stimulation of basal, adrenaline- as well as glucagon-stimulated form(s) of adenylate cyclase.

3 In contrast to cadmium, subacute administration of zinc ($ZnCl_2$, 2 mg/kg twice daily for 7 days) fails to alter the activities of hepatic gluconeogenic enzymes, cyclic AMP synthesis, as well as glucose clearance and insulin release in response to a glucose load.

4 Zinc, when administered at the same time as cadmium, prevents the cadmium-induced lesions in both hepatic and pancreatic functions.

5 The results are discussed in relation to the possible mechanisms of cadmium toxicity and to the role of sulphydryl groups in the protection exercised by zinc.

Introduction

Cadmium (Cd) is closely related to zinc (Zn) and is found wherever Zn is found in nature. Although Cd and Zn have similar chemical properties, each element affects the mammalian organism diversely and is handled differently by it. Zinc is an essential trace element necessary for the maintenance of normal biochemical functions and whose absorption and turnover are under homeostatic regulatory mechanisms (Halsted, Smith & Irwin, 1974). Cadmium, on the other hand, is a highly toxic, non-essential element that does not obey homeostatic control and accumulates in the organism with age (Schroeder & Balassa, 1961; Cotzias, Borg & Selleck, 1961).

Parizek (1957) demonstrated that Cd-induced testicular degeneration could be prevented by Zn and, more recently, the administration of several other trace metals such as selenium (Se) (Mason & Young, 1967; Merali & Singhal, 1975), iron (Sansi & Pond, 1974), and copper (Hill, Mafrone, Payne & Barber, 1963) has also been found to prevent several of the Cd-induced lesions in experimental animals.

It has recently been demonstrated that Cd affects hepatic carbohydrate and cyclic adenosine 3′,5′-monophosphate (cyclic AMP) metabolism (Sporn, Dinu & Stoonescu, 1970; Stowe, Wilson & Goyer, 1972; Singhal, Merali, Kacew & Sutherland, 1974; Merali & Singhal, 1975) as well as pancreatic function in the mouse, rat (Ghafghazi & Mennear, 1973, 1975; Ithakissios, Ghafghazi, Mennear & Kessler, 1975; Merali & Singhal, 1975) and man (Murata, Hirono, Saeki & Nakagawa, 1970). The purpose of the present study was two-fold: (1) to compare the effects of subacute Zn-exposure to those of subacute Cd-intoxication on hepatic carbohydrate and cyclic AMP metabolism as well as pancreatice function and (2) to investigate whether simultaneous administration of Zn can ameliorate the Cd-induced biochemical and functional changes in rats. A 7 day multiple dosing schedule of Cd administration was selected because it was found to induce certain changes in carbohydrate metabolism resembling those produced by chronic Cd-exposure (Singhal *et al.*, 1974). Our results demonstrate that even though Zn, by itself, is without significant effect, it can, when administered at the same time as Cd, effectively protect animals against the Cd-induced alterations in hepatic glucose-production, cyclic AMP metabolism and insulin-secretion.

Methods

Male rats of the Sprague-Dawley strain (200–225 g) employed in this study were maintained on Master Laboratory Chow and water *ad libitum* throughout the experimental period. One group of rats received cadmium (Cd) ($CdCl_2$, 1 mg/kg, twice daily) while the second group was treated with zinc (Zn) ($ZnCl_2$, 2 mg/kg, twice daily) for 7 days. In the protection experiment, Zn ($ZnCl_2$, 2 mg/kg, twice daily) was administered simultaneously with Cd ($CdCl_2$, 1 mg/kg, twice daily) but at a different site. The daily dose of each compound was administered subcutaneously in two equal aliquots at 12 h intervals, and this schedule was followed for 7 consecutive days. Control rats received equal volumes of 0.9% w/v NaCl solution (saline).

All animals were deprived of food overnight (16 h) and killed 24 h after the administration of the final dose(s). The activities of gluconeogenic enzymes, levels of urea, protein, cyclic AMP, glucose and insulin as well as the glucose tolerance tests were measured as described previously (Merali & Singhal, 1975). The activity of hepatic adenylate cyclase was assayed according to the procedures of Sutherland, Rall & Menon (1962). Adrenaline (50 µM), glucagon (10 µM) and Na fluoride (10 mM) were added to the incubation medium in order to measure the fluoride- and hormone-stimulated form(s) of adenylate cyclase; enzyme activity being expressed as pmol of cyclic AMP formed per mg tissue during a 10 min incubation period.

Statistics

The data were analyzed for significance of differences by Student's *t* test.

Results

Influence of subacute exposure to Cd, Zn or Zn plus Cd on glucose tolerance in intact rats

Blood glucose concentrations were determined immediately before as well as 15, 30 and 60 min after the glucose load (2.0 g/kg, i.p.) (Figure 1). Although Zn failed to alter the resting blood glucose level, exposure to Cd significantly elevated it to 122% of the control value. Simultaneous administration of Zn and Cd resulted in a blood glucose level that was significantly lower than that observed in the group exposed to Cd alone. Peak blood glucose values in response to the glucose load were attained at 15 min in all groups examined; however, this value in Cd-pretreated rats was significantly greater (38%) than that of control animals. Rats pretreated with Zn as well as Cd attained a blood glucose level that was in the same range as that of control animals. Similarly, at 30 and 60 min intervals, Cd-pretreated rats attained a significantly higher blood glucose level than those of Zn- or Zn plus Cd-pretreated rats; the results from the latter two groups not being significantly different from those of the control rats.

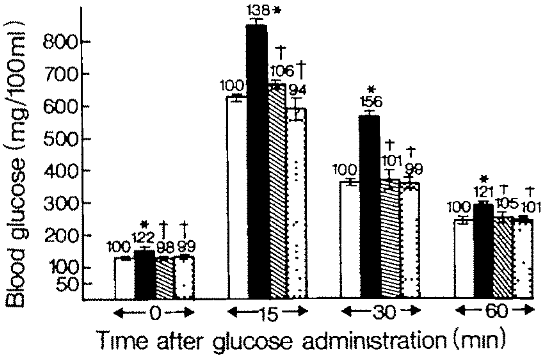

Figure 1 Effects of Zn on Cd-induced loss of glucose tolerance. Glucose tolerance test was carried out 24 h after the administration of the final dose(s) of Cd and/or Zn by giving a glucose load (2.0 g/kg i.p.). Each column represents the mean of 5–6 animals. Vertical lines show s.e. mean. Data are also given above each column as percentages of the values from the respective control groups. Open columns = control; solid columns = Cd, 1 mg/kg twice daily for 7 days; dotted columns = Zn, 2 mg/kg twice daily for 7 days; cross-hatched columns = Zn plus Cd. * Values significantly different from control values at $P < 0.05$. † Values significantly different from the values of Cd-pretreated rats at $P < 0.05$.

Effects of glucose load on serum levels of immunoreactive insulin of rats exposed to Cd and/or Zn

Figure 2 demonstrates that immediately before glucose administration, serum concentration of immuno-reactive insulin (IRI) of rats pretreated with Zn remained within the normal range. In contrast, the serum IRI level in rats exposed to Cd was considerably depressed. Rats exposed to Cd and Zn simultaneously on the other hand, displayed normal serum IRI content. Glucose administration (2 g/kg) produced prompt elevation in serum IRI concentration, which like the glucose level, peaked at the 15 min time point. In the Zn group, glucose load evoked a normal elevation in serum IRI level; however, in rats pretreated with Cd, statistically significant suppression of glucose-stimulated serum IRI increase was noted at 15, 30 and 60 minutes. In animals receiving Zn plus Cd simultaneously, glucose load elicited a consistently greater increase in serum IRI concentration than it did in the group pretreated with Cd alone, and was not significantly different from the control value.

Table 1 shows the total amount of IRI released in various groups in the 1 h period after glucose load, as calculated by integrating the area under the appropriate curve. It can be seen that the total amount of IRI released by Cd-intoxicated animals was significantly lower than in control animals. Zinc treatment, by itself, did not significantly alter the

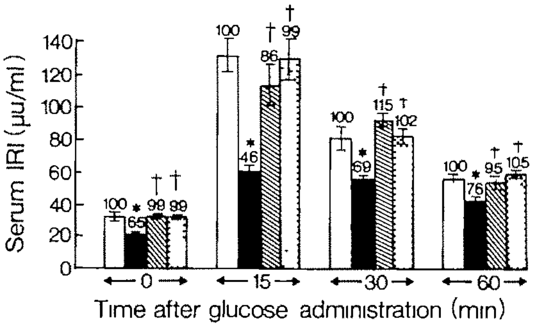

Figure 2 Effect of treatment with Cd, Zn, or Zn plus Cd on immuno-reactive insulin (IRI) release in response to a glucose load. Glucose (2 0 g/kg i p) was administered 24 h after the final dose(s) of Cd and/or Zn Each column represents the mean of 5–6 animals Vertical lines show s e mean Data are also given above each column as percentages of the values from the respective control groups. Open columns=control, solid columns=Cd, 1 mg/kg twice daily for 7 days, dotted columns=Zn, 2 mg/kg twice daily for 7 days; cross-hatched columns=Zn plus Cd. * Values significantly different from the values of control animals at $P<0\ 05$. † Values significantly different from values of Cd-pretreated rats at $P<0\ 05$.

amount of IRI released. However, in rats receiving both Zn and Cd simultaneously, significantly more IRI was released than in rats receiving Cd alone.

Activities of hepatic gluconeogenic enzymes after exposure to Cd and/or Zn

Administration of Cd significantly elevated the activities of pyruvate carboxylase (PC) phosphoenolpyruvate carboxykinase (PEPCK), fructose 1,6-diphosphatase (FD-Pase) and glucose 6-phosphatase (G6-Pase) (Table 2). On the other hand, exposure to Zn failed to produce any significant change in the activities of these four enzymes. When Zn and Cd were administered concurrently, the activities of all four gluconeogenic enzymes were significantly lower than those noted for rats given Cd alone, and were in the same range as control values. In contrast to the gluconeogenic enzymes, Cd-treatment resulted in a reduction of hepatic glycogen level. Although Zn by itself was without any appreciable effect, when given in combination with Cd, it prevented the Cd-induced fall in liver glycogen. Cadmium treatment also increased serum urea by 61% and this rise was effectively prevented by simultaneous administration of Zn, although Zn alone was without any significant effect.

Concentrations of hepatic cyclic AMP in rats exposed to Cd, Zn or both

Subacute exposure to Cd resulted in a marked increase in hepatic cyclic AMP concentration (Table 3). Treatment with Zn alone failed to alter hepatic cyclic AMP significantly. However, when Zn was administered at the same time as Cd, the observed elevation in cyclic AMP level was prevented and the value remained in the range of the control value.

Effects of Cd and Zn on adenylate cyclase activity

Results in Figure 3 demonstrate that Cd-induced elevation of the hepatic cyclic AMP level was accompanied by enhancement in the activity of the cyclic AMP synthesizing enzyme, adenylate cyclase. Adrenaline, fluoride, and glucagon were all able to stimulate adenylate cyclase activity in both normal and Cd-exposed animals; however, in Cd-exposed rats, glucagon and adrenaline could stimulate the enzymatic activity to levels higher than in the corresponding controls whereas fluoride could not. Furthermore, although Zn by itself did not alter the sensitivity of adenylate cyclase to adrenaline,

Table 1 Effects of subacute Cd and/or Zn on integrated immuno-reactive insulin (IRI) levels over a 60 min period after administration of a glucose load

Treatment	*Dose (mg kg⁻¹ day⁻¹)*	*Estimated total insulin released (min x μu/ml)*	*Percent of control*
Control	0.0	2938 ± 266	(100)
Cd	2 x 1.0	1691 ± 93	(58)*
Zn	2 x 2.0	3010 ± 201	(102)†
Zn+ Cd	2 x 2.0 2 x 1.0	2903 ± 220	(99)†

Each value represents the mean ± s.e. mean of 5–6 rats per group
* Significantly different from control values at $P<0.05$; † Significantly different from values of Cd-treated group at $P<0.05$

glucagon or fluoride, administration of this trace element concurrently with Cd significantly prevented the Cd-stimulated increase in the activity of basal as well as the hormone-stimulated forms of the hepatic enzyme.

Discussion

The results reported in this study demonstrate that the toxic effects of Cd on hepatic metabolism and pancreatic function can be effectively prevented by simultaneous administration of Zn.

In rats, subacute Cd treatment resulted in suppression of pancreatic function as demonstrated by marked reduction of glucose tolerance associated with a decrease in the glucose-stimulated insulin release. The mechanism by which Cd suppresses the insulin secretory response is not clear. Perfusion of isolated pancreas of rat with Cd was found to inhibit the insulin secretory response to glucose, tolbutamide or potassium ions (Ghafghazi & Mennear, 1975)

Table 2 Protective effect of Zn on Cd-induced alterations in hepatic glycogen, gluconeogenic enzymes and serum urea levels

	Treatment			
Parameters examined	*Control*	*Cd*	*Zn*	*Zn+Cd*
PC	306±5.7 (100)	430±13.7 (141)* [100]	316±4 8 (103) [73]†	305±8.8 (100) [71]†
PEPCK	9.8±0.61 (100)	18 1±2 04 (185)* [100]	9.05±0.69 (92) [50]†	10.6±1.09 (108) [58]†
FD-Pase	6.05±0.31 (100)	7.86±0 50 (130)* [100]	6.49±0.17 (107) [83]†	6.24±0 29 (103) [79]†
G6-Pase	2.32±0.13 (100)	2 90±0.11 (125)* [100]	2.35±0.26 (101) [81]†	2.30±0.05 (99) [80]†
Glycogen	2 18±0.2 (100)	1.43±0.09 (65)* [100]	1 95±0 16 (89) [136]†	2.23±0.26 (102) [157]†
Urea	17 6±0 50 (100)	28.4±1.15 (161)* [100]	18.4±0.51 (104) [65]†	18 4±0.51 (104) [65]†

PC=pyruvate carboxylase; PEPCK=phosphoenolpyruvate carboxykinase; FD-Pase=fructose 1,6-diphosphatase; G6-Pase=glucose 6-phosphatase. Each value represents the mean±s e mean of 5–6 animals. Data are also given in parentheses as percentages of the values of control ( ) or Cd-treated [ ] animals
* Significantly different from control values at $P<0.05$; † Significantly different from values of Cd-treated rats at $P<0.05$.

Table 3 Protective effect of Zn against the Cd-induced increase in hepatic cyclic AMP levels

Treatment	*Dose (mg kg^{-1} day^{-1})*	*Cyclic AMP level (pmol/mg tissue)*	*Percent of control*
Control	0.0	0 74±0 01	(100)
Cd	2×1.0	1.36±0.06	(184)*
Zn	2×2.0	0.80±0.03	(108)†
Zn+ Cd	2×2.0 2×1 0	0.79±0 02	(106)†

Each value represents the mean±s.e. mean of 5–6 rats per group
* Significantly different from control values at $P<0$ 05, † Significantly different from values of Cd-treated group at $P<0.05$.

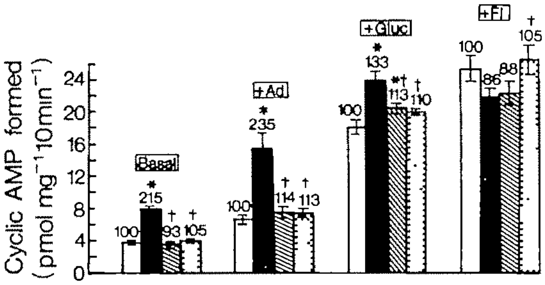

Figure 3 Protection by Zn of Cd-induced alterations in the responsiveness of hepatic adenylate cyclase to adrenaline (Ad), glucagon (Gluc) or fluoride (Fl). Each column represents the mean of 5–6 animals. Vertical lines show s.e. mean Data are also given above each column as percentages of the values from the respective control groups. Open columns = control, solid columns = Cd, 1 mg/kg twice daily for 7 days; dotted columns = Zn, 2 mg/kg twice daily for 7 days; cross-hatched columns = Zn plus Cd. * Values significantly different from the values of control animals at $P < 0.05$ † Values significantly different from the values of Cd-treated rats at $P < 0.05$.

indicating, that Cd may be inflicting damage directly at the level of pancreatic insulin secretory mechanism(s). Considerable attention has been directed to the possible importance of Zn in the aetiology of diabetes. There appears to be significantly less Zn concentrated in the diabetic pancreas in comparison to the normal tissue (Lowry, Baldwin & Harrington, 1954). Furthermore, several investigators have reported decreased glucose tolerance and glucose-stimulated insulin release in Zn-deficient rats (Huber & Gershoff, 1973; Halstead *et al.*, 1974). This impairment in Zn-deficient animals appears to be similar to that reported in the present study for Cd-intoxicated rats and is of particular interest in view of the present finding that the pancreatotoxic effects of Cd were prevented by simultaneous administration of Zn. This suggests that Cd, as an 'antimetabolite' of Zn (Bremner, 1974), may be suppressing the pancreatic function either by replacing functional Zn or by altering the availability of the essential trace metal; the effect(s) being overcome by the exogenously administered Zn.

There is evidence that SH groups play an important role in the mechanism(s) leading to the release of stored insulin from pancreatic β cells (Havu, 1969; Watkins, Cooperstein & Lazarow, 1970; Watkins & Moore, 1974; Hellman, Idahl, Lernmark, Sehlin & Täljedal, 1975). These observations are of interest since like alloxan (a potent diabetogenic agent), Cd is also a potent SH inhibitor (Havu, 1969). The exact mechanism by which the interaction with pancreatic SH groups results in altered insulin secretory activity is not known. However, studies indicate that both the mono- and dithiol-inhibitors (including Cd) are potent Zn releasers in sculpin islets (Havu, 1969). Since Zn-thiol interactions are known to occur in biological systems, it is possible that exogenous Zn might be affording protection against Cd-induced pancreatic damage by interacting with SH groups (and thus preventing SH-Cd interaction and the consequent loss of Zn). It is of interest that administration of selenium (Se) simultaneously with Cd has also been found to prevent partially the Cd-induced pancreatic damage (Merali & Singhal, 1975). It was suggested that Se might afford protection to the pancreas by preventing the Cd-SH interactions and consequently sparing Cd-induced Zn loss (Merali & Singhal, 1975). This hypothesis may represent a common mechanism by which two diverse elements, Zn and Se, might act to prevent the Cd-induced pancreatic damage.

Insulin reduces the blood glucose level not only by increasing the membranal transport of sugars but also by enhancing the conversion of glucose into glycogen and triglycerides and decreasing the hepatic glucose production (Walaas, Walaas & Grønnerød, 1974). Conversely, insulin deficiency caused either by insulin anti-serum or alloxan treatment increases blood glucose, cyclic AMP as well as glucose synthesis in the liver and reduces its glycogen content (Exton & Park, 1968; Wicks, 1969; Exton, 1972). Since these observations appear to be similar to those noted in Cd-intoxicated animals, it seems likely that the effects of Cd treatment may be due, at least in part, to a lack of insulin. Furthermore, the ability of Zn to prevent various Cd-induced hepatotoxic effects may be related indirectly to its protective effect against Cd-induced insulin diminution.

Cadmium treatment resulted in increased serum urea level. Since Cd is known to cause kidney damage (Stowe *et al.*, 1972), the high blood urea level could be due, at least in part, to renal damage. Simultaneous administration of Zn also prevented Cd-induced uremia.

It has been postulated that Cd is rendered innocuous by its rapid incorporation into a protein called metallothionein whose synthesis is stimulated by Cd (Colucci, Winge & Krasno, 1975). Recent studies also suggest that Zn may stimulate the formation of a metallothionein-like protein which, in addition to concentrating Zn, may also sequester Cd (Bremner & Davies, 1974). This may therefore represent a detoxifying mechanism.

Cyclic AMP is believed to play an important role in processes of gluconeogenesis as well as glycogenolysis (Sutherland & Robison, 1969; Exton, 1972). In the present study, Cd caused a significant elevation in hepatic cyclic AMP content. Since administration of cyclic AMP has also been found to increase blood glucose and urea levels, enhance synthesis of glucose from non-carbohydrate precursors and lower hepatic glycogen concentration (Menahan & Wieland, 1967;

Exton & Park, 1968; Greengard, 1969; Wicks, 1971), it would appear that the Cd-induced changes in hepatic carbohydrate metabolism resemble those produced by cyclic AMP. Furthermore, since insulin deficiency has been found to elevate the hepatic cyclic AMP concentration (Exton, 1972), the observed increase in cyclic nucleotide levels may be related to the Cd-induced insulin deficiency.

The Cd-induced elevation of hepatic cyclic AMP was accompanied by stimulation of the basal, adrenaline-, as well as glucagon-stimulated form(s) of adenylate cyclase. However, the responsiveness of the enzyme to fluoride remained unaltered. This is concordant with the view that fluoride ion acts through some direct action on the catalytic component and not through the hormone-discriminators (Birnbaumer, Phol & Rodbell, 1971). Intoxication with Cd increased the responsiveness of hepatic adenylate cyclase to adrenaline by a greater degree than to glucagon. This may be relevant to the recent finding that the state of diabetes increases the adrenaline-sensitive adenylate cyclase activity of rat liver (Bitensky, Gorman & Neufeld, 1972). Possibly, the protective effect of Zn against Cd-induced changes in hormone-sensitivity of hepatic adenylate cyclase may be secondary to the prevention of pancreatic damage by Zn.

The present investigation in conjunction with a previous report (Merali & Singhal, 1975) indicates that interactions between Cd, Zn and Se may underlie the observed hepatotoxic and pancreatotoxic effects of Cd in mammals. It is apparent that a clearer understanding of trace element metabolism will be fruitful not only to our understanding of heavy metal toxicities but also to the development of adequate prophylactic and detoxication measures against the inadvertent exposure to heavy metal pollutants.

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THE VASODILATOR ACTIONS OF ISOPRENALINE, HISTAMINE, PROSTAGLANDIN E_2, GLUCAGON AND SECRETIN ON THE HEPATIC ARTERIAL VASCULAR BED OF THE DOG

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1 The sympathetically-innervated arterial vascular bed of the dog's liver was perfused from a femoral artery. Arterial blood flow and perfusion pressure were measured continuously, and the hepatic arterial vascular resistance calculated. The preparation provided a means of assessing hepatic arterial vasodilatation quantitatively.

2 Isoprenaline, histamine, prostaglandin E_2, glucagon and secretin were injected intra-arterially and all evoked dose-dependent vasodilatation of the hepatic arterial vascular bed.

3 The maximum reduction in the calculated hepatic arterial vascular resistance of 37–38% was the same for each of the five substances.

4 Comparisons on a weight basis revealed that prostaglandin E_2 was the most potent, followed in potency order by secretin, isoprenaline, histamine and glucagon.

5 Comparisons on a molar basis showed that secretin and prostaglandin E_2 were intrinsically considerably more potent than isoprenaline, histamine or glucagon.

6 The onset of the vasodilatator responses to secretin, isoprenaline, histamine and prostaglandin E_2 was rapid, and the duration of their actions was brief.

7 The onset of the vasodilator effects of glucagon was slow and its duration of action very prolonged.

8 The implications of these observations with respect to the physiological control of the hepatic arterial vascular bed of the dog are discussed.

Introduction

In previous publications (Richardson & Withrington, 1975; 1976), the range of vasoconstrictor responses of the hepatic arterial vascular bed to noradrenaline, angiotensin and vasopressin, substances which are likely to be circulating under various physiological circumstances, was established. Those experiments also revealed that glucagon, an established gastrointestinal hormone, had two significant actions on the hepatic arterial vascular bed of the dog. It provoked hepatic arterial vasodilatation, and antagonized the hepatic arterial vasoconstrictor actions of noradrenaline, angiotensin and vasopressin.

We have now studied the actions of another gastrointestinal hormone, secretin, on the hepatic arterial vascular bed. In addition, two potent naturally-occurring vasodilator substances, histamine and prostaglandin E_2 have been studied. Although not normally present in the systemic circulation in vasoactive amounts, they may be synthesized within the liver or may enter the liver in the portal vein and so could modify hepatic arterial vascular resistance. The present experiments were designed to examine the dose-response relationships, relative potencies and time-courses of the vascular actions of these naturally occurring agents on the hepatic arterial bed. In addition the vasodilator effects of the synthetic catecholamine, isoprenaline, were examined for comparative purposes in the establishment of the relative activities of the vasodilator hormones.

Methods

Experiments were performed on 12 dogs weighing between 10.5 and 17.5 kg (14.7 ± 2.3 kg; mean ± s.d.) which had been deprived of food for 24 h, but allowed unrestricted access to water. Anaesthesia was induced by an intravenous injection of methohexitone sodium (Brietal, Lilly; 7.5–10.0 mg/kg) and maintained with chloralose (Kuhlmann, Paris; 50 mg/kg i.v.) and urethane (BDH; 500 mg/kg i.v.), supplementary doses of chloralose and urethane being given as necessary to maintain a constant level of anaesthesia.

Following a midline laparotomy, the common hepatic artery was separated from its periarterial sympathetic nerves. In contrast to previous experiments (Richardson & Withrington, 1976) in which these nerves were divided, in the present series of experiments, they were carefully preserved to maintain a sympathetic vasoconstrictor tone to the hepatic arterial vasculature. The animals were injected with heparin (Weddel Pharmaceuticals; 250 i.u./kg, i.v., followed by supplements of 100 i.u./kg hourly), the common hepatic artery cannulated close to its origin from the aorta, and perfused with blood from a cannulated femoral artery. The blood flow through the cannula between the femoral artery and the hepatic artery (hepatic arterial blood flow; HABF) was measured with a cannulated flow probe and electromagnetic flowmeter (Cardiovascular Instruments Limited) and the hepatic arterial perfusion pressure (PP) was measured from a 'T'-piece close to the point of cannulation of the hepatic artery with a Consolidated Electrodynamics L212 strain gauge transducer. The cannula system carried additional 'T'-pieces for the intra-arterial administration of vasoactive substances.

On completion of surgery, the abdominal incision was closed, a thermometer inserted into the abdominal cavity, and the intra-abdominal temperature maintained at 37–38°C with table heaters and radiant lamps; stable control variables were recorded for at least 20 min before the administration of any drugs or hormones.

To monitor possible systemic effects of the vasoactive agents, phasic systemic arterial blood pressure was measured with a Statham P23Gb strain gauge transducer from the cannulated right femoral artery, and heart rate derived electronically from this measurement.

After appropriate amplification, all variables were displayed continuously on a Devices M 19 recorder.

Calculation of results

Liver weight was obtained immediately after each experiment. Values expressed per 100 g refer to this terminal weight of liver.

Hepatic arterial mean perfusion pressure (PP) was derived electronically from the phasic waveform with a Devices model 3502 averaging circuit with time constants of 0.5, 1 and 2 s, selected appropriately. Both mean and phasic pressure records were displayed continuously.

Hepatic arterial mean blood flow (HABF) was derived electronically by passing the phasic waveform through an averaging circuit with a time constant of 0.6 second. Both mean and phasic flow records were displayed continuously.

Hepatic arterial vascular resistance (HAVR) was calculated as hepatic arterial mean perfusion pressure (mmHg) divided by hepatic arterial mean blood flow (ml/min, or ml min^{-1} 100 g^{-1}) and expressed as mmHg ml^{-1} min, or mmHg ml^{-1} min 100 grams.

Changes in vascular resistance were calculated as percentage changes from the control values immediately before any procedure, i.e. (change in vascular resistance × 100)/(control vascular resistance).

When large doses of the vasodilator agents were injected intra-arterially to the liver, there were large increases in blood flow accompanied by small reductions in perfusion pressure. Since a change in perfusion pressure itself may cause myogenic and hydrostatic adjustments in the tone of resistance vessels, resulting in alterations in vascular resistance (Bayliss, 1902; Folkow, 1964), the possible contribution of such changes to the effects measured in the present experiments was examined. On 15 occasions in 5 preparations, the PP was reduced by graded occlusions of the hepatic arterial cannula, and pressure/resistance curves constructed. When the PP was reduced in this way, by the same amount as the reduction caused by maximal doses of the vasodilator substances (by 11.3 ± 0.7 mmHg from a control of 119.2 ± 4.8 mmHg; $n=28$), the hepatic arterial vascular resistance (HAVR) rose by about 3% from 1.94 ± 0.15 to 2.00 ± 0.17 (mean ± s.e. mean, $n=15$) mmHg ml^{-1} min 100 grams.

Since the HAVR fell by about 38% on injection of maximal doses of all the vasodilator substances (see results), the small change in HAVR due to the reduced perfusion pressure is insignificant and correction factors have not been applied.

Expression of results

Except where indicated to the contrary, results are expressed as means ± s.e. means.

Where the term ED_{50} is used, it indicates the dose of a drug producing 50% of the maximum response that could be elicited by progressively increasing intra-arterial injections of that drug.

The time course of the responses to each of the substances are expressed numerically as the time taken for 50% recovery from the maximum effect ($T\frac{1}{2}$) of a selected dose of each substance. The dose selected for this analysis was a just-submaximal dose which produced the same reduction in HAVR for each substance.

Drugs

The drugs used, and the forms in which their weights

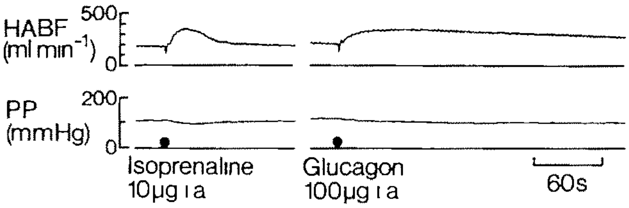

Figure 1 Time courses of the responses of the hepatic arterial vascular bed to intra-arterial injections of Isoprenaline and glucagon HABF=hepatic arterial blood flow, PP=hepatic arterial mean perfusion pressure.

are expressed were: glucagon hydrochloride (Lilly; base), histamine acid phosphate (BDH; salt), isoprenaline sulphate (MacCarthay; salt), prostaglandin E_2 (Prostin E_2, Upjohn) and natural secretin (Boots). Doses of secretin are expressed in Crick-Harper-Raper Units where 1 unit is equivalent to 62.5 ng (manufacturer's data).

Drugs were dissolved in, or diluted from ampoules with 0.9% w/v NaCl solution (saline). Intra-arterial injections were made at a point between the flow probe and hepatic arterial cannula, resulting in an injection artefact which was very clearly separable from subsequent drug-induced changes in HABF and PP (Figure 1).

Intra-arterial infusions were from a Watson-Marlow MHRE-200 pump precalibrated to deliver 1.0 ml/min against pressures in excess of 150 mmHg.

The volume of blood in the external circuit was compensated for by injecting an equal volume of a solution of low molecular weight dextran in saline (Rheomacrodex, Pharmacia) intravenously.

Results

Control values

The livers weighed 312.8 ± 6.4 (s.d.) g, representing 2.12 ± 0.27 (s.d.) % of the weight of the dogs. Under control conditions, the hepatic arterial mean perfusion pressure (PP) was 124.3 ± 5.9 mmHg and the hepatic arterial mean blood flow (HABF) 63.6 ± 5.9 ml min^{-1} 100 g^{-1}, giving a calculated hepatic arterial vascular resistance (HAVR) of 2.18 ± 0.25 mmHg ml^{-1} min 100 grams. The heart rate was 177.0 ± 12.0 beats/minute.

The effects of the vasoactive agents

Isoprenaline, histamine, prostaglandin E_2, glucagon and secretin were injected into the hepatic artery in increasing doses from below threshold to doses in excess of the maximum responses. From the changes in calculated HAVR, $\log_{10}$ dose-response curves were constructed for each substance, the doses being expressed both in terms of the weight of the substance used and, in order to compare the intrinsic potencies of the five substances, in terms of the fraction of one mole of the agent injected.

Isoprenaline was injected into the hepatic artery in increasing doses from 10 ng to 50 μg on 8 occasions in 5 preparations: hepatic arterial vasodilatation, manifest as an increase in HABF with small reductions in PP at the highest doses, was the only effect observed (Figure 1). The reduction in calculated HAVR was dose-dependent (Figure 2a), the lowest dose at which effects were observed being between 10 and 50 ng, and maximum effects being attained on injection of 20 or 50 μg. The maximum reduction in HAVR was 38.1 ± 1.9% (Table 2) and the changes in HABF, PP and calculated HAVR at maximum vasodilatation are shown in Table 1.

The vasodilatation elicited by isoprenaline was of rapid onset and short duration, the time taken for 50% recovery from the peak changes ($T\frac{1}{2}$) of the test dose being 21.4 ± 2.7 s (Figure 1; Table 2).

Histamine was injected in doses between 10 ng and 20 μg on 5 occasions in 3 preparations, resulting in hepatic arterial vasodilatation at all doses above the threshold of 50 or 100 ng. The reduction in calculated HAVR was dose-dependent (Figure 2a), reaching a maximum of 37.4 ± 4.5% at 10 or 20 μg; the changes in blood flow and perfusion pressure at maximal vasodilatation are shown in Table 1.

The effects of histamine were of rapid onset and brief duration, the $T\frac{1}{2}$ for recovery from the vasodilatation being 14.2 ± 1.4 s (Table 2).

Prostaglandin E_2 was injected intra-arterially to the liver in doses from 0.5 ng to 5 μg on 8 occasions in 5 preparations, resulting in a reduction in calculated HAVR at all doses above the threshold of 1 or 5 ng (Figure 2a). The maximum reduction in HAVR attained on injection of prostaglandin E_2 was 37.4 ± 1.9%, the doses producing the maximum effect being between 0.5 and 5 μg. The changes in HABF and PP at maximum vasodilatation are shown in

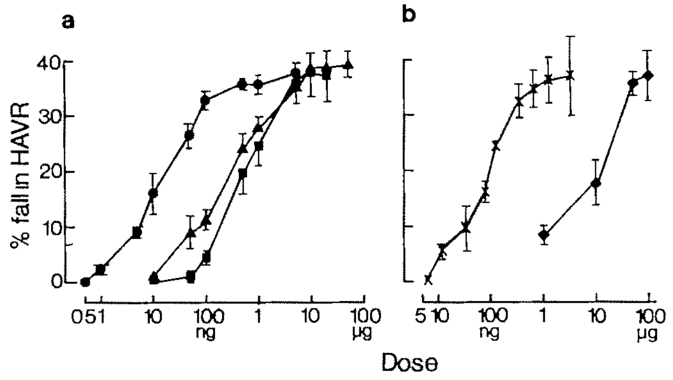

Figure 2 Log$_{10}$ dose-response curves to the five vasodilators used. The doses are expressed in terms of the weight of each substance injected intra-arterially, and the response is the percentage reduction in calculated hepatic arterial vascular resistance (HAVR). (a) Dose-response curves to isoprenaline (▲), histamine (■), and prostaglandin E_2 (●). (b) Dose-response curves to glucagon (◆) and secretin (×). The symbols represent the mean observations (for isoprenaline, $n=8$, for histamine, $n=5$, for prostaglandin E_2, $n=8$, for glucagon, $n=4$, and for secretin, $n=3$) and the vertical lines show the s.e. means

Table 1; the $T_{\frac{1}{2}}$ to recovery from the peak effect of the selected dose of prostaglandin E_2, 0.5 µg, was 18.2 ± 1.6 s.

The solution of prostaglandin E_2 contained a small amount of ethanol; when 1 µg of prostaglandin E_2 was injected, an amount of ethanol equivalent to 0.5 ml of 0.2% ethanol in saline was injected. Whilst this dose of prostaglandin E_2 produced 92.9 ± 1.7% of the maximum vasodilator response, injecting the corresponding amount of ethanol did not influence the HAVR.

Glucagon (1, 10, 50 and 100 µg) was injected into the hepatic artery, and brought about considerable increases in HABF with small reductions in PP at the higher doses (Figure 2b, Tables 1 and 2). This procedure was adopted in each of 4 experiments and the mean maximum reduction in calculated HAVR

Table 1 Hepatic arterial perfusion pressure (PP) blood flow (HABF) and calculated vascular resistance (HAVR) immediately before, and at the peak of responses to maximal vasodilator doses of each agent

PP (mmHg)	*PP*	*HABF (ml min^{-1} 100 g^{-1})*	*HABF*	*HAVR (mmHg ml^{-1} min 100 g)*	*HAVR*
Control	*Peak*	*Control*	*Peak*	*Control*	*Peak*
Isoprenaline (n=8)					
122.3 ± 9.2	109.0 ± 8.0	56.8 ± 6.5	85.8 ± 8.3	2.30 ± 0.24	1.34 ± 0.13
Histamine (n=5)					
129.0 ± 9.4	116.4 ± 8.6	41.2 ± 6.1	61.4 ± 6.8	3.34 ± 0.47	2.04 ± 0.35
Prostaglandin E_2 (n=8)					
116.1 ± 6.6	107.5 ± 5.6	53.0 ± 5.3	79.0 ± 8.8	2.32 ± 0.23	1.46 ± 0.18
Glucagon (n=4)					
111.8 ± 6.1	101.3 ± 6.9	59.6 ± 7.2	90.9 ± 11.1	1.96 ± 0.24	1.17 ± 0.16
Secretin (n=3)					
107.3 ± 12.7	98.3 ± 13.5	50.7 ± 4.8	74.0 ± 6.3	2.20 ± 0.18	1.36 ± 0.21

Each value is the mean ± s.e. mean immediately before (Control) and at the peak of the responses to maximal vasodilator doses (Peak) of each agent. The number of dose-response curves from which these data were derived is shown in parentheses after the name of the drug.

was 37.1 ± 4.3%. The time course of the effects of glucagon was different from that of the other four agents, being slow in onset and of very long duration (Figure 1), the $T\frac{1}{2}$ for recovery from the peak effects of 100 μg glucagon being 219.0 ± 16.5 s, a value more than ten times larger than for the other four substances examined.

Secretin. Complete dose-response curves to secretin were constructed on 3 occasions in 3 experiments by injecting doses between 100 mu (6.25 ng) and 50 u (3.13 μg) intra-arterially to the liver. At doses above the threshold of 200 mu, there were increases in HABF and at the highest doses small reductions in PP, resulting in reductions in the calculated vascular resistance of up to 37.1 ± 4.3% (Figure 2b, Tables 1 & 2). Maximum effects were observed on injection of between 5 and 20 u (0.31 to 1.25 μg), and the effects were of rapid onset and short duration, the $T\frac{1}{2}$ to recovery from the maximum effects of 20 u being 19.8 ± 3.1 s, values similar to those for isoprenaline, histamine and prostaglandin E_2.

Relative vasodilator potency of isoprenaline, histamine, prostaglandin E_2, glucagon and secretin

The maximum reduction in hepatic arterial vascular resistance attained with each agent was the same at about 37–38% (Table 2), but the potencies of the five substances differed considerably. From Figure 1, the weight of each substance which produces 50% of the maximum reduction in HAVR has been measured (Table 2) to give an indication of the potency order. On this weight basis, prostaglandin E_2 is the most potent vasodilator, followed by secretin, isoprenaline, histamine and glucagon. A more meaningful indication of the relative intrinsic potencies of the substances is achieved by considering the effects of fractions of one mole of each agent. In Figure 3, the dose-response curves for all five substances are plotted as the fraction of one mole of the substance on a

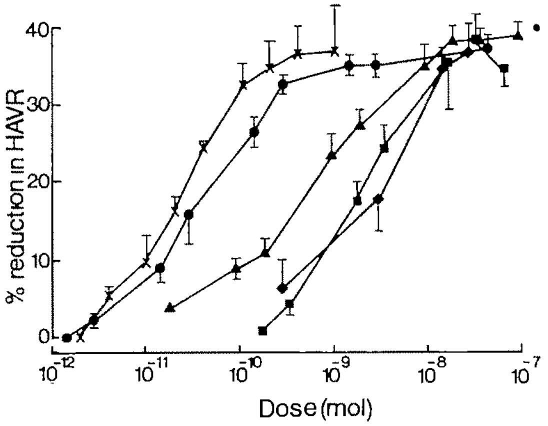

Figure 3 Log_{10} dose-response curves for isoprenaline (▲), histamine (■) prostaglandin E_2 (●), glucagon (◆) and secretin (×) on the canine hepatic arterial vascular bed. The dose is expressed as a fraction of one mole of each agent injected intra-arterially, and the response as the % fall in calculated hepatic arterial vascular resistance (HAVR) The symbols represent the mean observations and the vertical bars show the s e. means. The numbers of observations are as for Figure 2.

Table 2 Maximum reductions in calculated hepatic arterial vascular resistance (HAVR), ED_{50} values, and times to half recovery from peak effects of selected doses of the vasodilator agents

Substance	*Maximum fall in HAVR (%)*	*ED_{50} (ng)*	*ED_{50} (mol)*	*Test (μg)*	*Time to 50% recovery from peak effect of test dose (s)*
Isoprenaline sulphate (n = 8)					
	38.1 ± 1.9	352	6.32×10^{-10}	10	21.4 ± 2 7
Histamine acid phosphate (n = 5)					
	37.4 ± 4.5	480	$1\ 56 \times 10^{-9}$	10	14.2 ± 1.4
Prostaglandin E_2 (n = 8)					
	37.4 ± 1 9	20.5	5.82×10^{-11}	0.5	18.2 ± 1.6
Glucagon (n = 4)					
	37 1 ± 4.3	1120	$3\ 21 \times 10^{-}$[illegible]	100	219.0 ± 16 3
Secretin (n = 3)					
	37.1 ± 4.3	80 0	2.62×10^{-11}	1.25	19.8 ± 3.1

Effects are shown as means ± s.e. mean.

logarithmic scale against the percentage reduction of vascular resistance. The curves to the left therefore represent substances with greater vasodilator potency than those to the right, and again the ED_{50} can be calculated for this type of expression of the dose-response relationships. From Figure 3, it is apparent that on a molar basis, secretin with an ED_{50} of 2.62×10^{-11} mol and prostaglandin E_2 with an ED_{50} of 5.82×10^{-11} mol are the most potent vasodilator substances when injected intra-arterially to the hepatic arterial vascular bed of the dog. Isoprenaline ($ED_{50} = 6.32 \times 10^{-10}$ mol) has less than one-tenth the potency of prostaglandin E_2, and histamine with an ED_{50} of 1.56×10^{-9} mol, and glucagon ($ED_{50} = 3.21 \times 10^{-9}$ mol) are even less potent as vasodilators.

Discussion

The present series of experiments were performed on the sympathetically-innervated liver of the dog and the control values for hepatic arterial blood flow, calculated hepatic vascular resistance and liver weights accord well with previously published data in the same species (Green, Hall, Sexton & Deal, 1959; Torrance, 1961; Richardson & Withrington, 1976).

The study of vasodilatation in the hepatic arterial bed has been almost entirely neglected since the low basal tone does not provide a suitable experimental preparation. In the present series it was found that provided care was taken to retain the sympathetic innervation to the liver, considerable increases in blood flow could be elicited regularly and repeatably on the injection of known vasodilator agents. The innervated liver therefore provides a preparation from which quantitative information may be obtained. The functional integrity of the sympathetic innervation to the liver was confirmed in some of the present experiments by temporary occlusion of the common carotid arteries, a procedure which elicited a reflex increase in hepatic arterial vascular resistance.

The present investigation was concerned with the increases in hepatic arterial blood flow due to the presence in the hepatic arterial blood of substances which either are normally present in the systemic circulation such as the gut hormones glucagon and secretin, or which may influence hepatic arterial vascular resistance either by being synthesized and released within the liver or by gaining access to the hepatic arterial bed through the portal vein (histamine, prostaglandin E_2). A comparison of the vasodilator properties of these naturally occurring compounds was made with the synthetic catecholamine, isoprenaline, the vasodilator properties of which are well established.

Large doses of isoprenaline injected or infused intra-arterially have been shown to elicit hepatic arterial vasodilatation in the dog (Scholtholt, Lochner, Renn & Shiraishi, 1967) but in the cat β-adrenoceptor responses have been found to be particularly difficult to elicit (Greenway & Stark, 1971). In the present experiments arterial injections of isoprenaline evoked marked and graded increases in hepatic arterial blood flow of short duration. On a molar basis it was amongst the least potent of the 5 substances tested.

Hepatic arterial vasodilatation in response to histamine has been observed previously (Galindo, 1965; Greenway & Stark, 1971). In the innervated liver histamine causes a dose-dependent increase in hepatic arterial bood flow of short duration. On a molar basis it was amongst the least active group, although the maximum decrease in hepatic arterial resistance was the same as with the other compounds investigated. The contention that histamine may act as a physiological vasodilator in some vascular beds has received considerable attention, particularly with regard to the hindlimb vasculature (Schayer, 1962; Beck, 1965) but it is unlikely to survive in the systemic blood at high concentrations unless histaminase inhibitors are administered (Ghosh & Schild, 1958; Buffoni, 1966). However, histamine is present in the liver under normal conditions (Best, Dale, Dudley & Thorpe, 1927); in addition, the gut contains large quantities of histamine (Roche e Silva, 1966) and under certain circumstances therefore the portal vein may contain detectable amounts. Histamine may alter the distribution of arterial blood in the hepatic parenchyma by having access to, and acting upon, those structures controlling hepatic arterial resistance. Factors which cause the release of histamine within the liver may include inflammation, arterial occlusion and anaphylactic reactions.

Injections of prostaglandin E_2 into the arterial supply to the liver caused marked, dose-dependent reductions in hepatic arterial vascular resistance; the time-course of the response was short. Together with secretin it was, intrinsically, the most active molecule in evoking hepatic vasodilatation with an ED_{50} of 5.8×10^{-11} mol. The high potency of prostaglandin E_2 as a hepatic arterial vasodilator prompts the question of its possible physiological role. Systemic circulating levels are low because of the effective removal by lung and liver (Vane, 1969). However, in the presence of the requisite enzymes synthesis is rapid so that, like histamine, local factors within the liver may stimulate the production of prostaglandin E_2 in amounts which could influence the arteriolar smooth muscle of the hepatic bed, modifying hepatic arterial resistance and the distribution of arterial blood within the liver. The gut contains and synthesizes prostaglandin E_2 which may be released in response to a number of stimuli (Horton, 1969). In the dog, it has been clearly shown that the spleen, when stimulated to contract by either nerve stimulation or intra-arterial injections of adrenaline, releases prostaglandin E_2 into the venous effluent which consequently enters the liver by the portal vein (Davies, Horton & Withrington, 1968; Gilmore, Vane & Wyllie, 1969). It is possible that the hepatic arterial vascular resistance may be altered by prostaglandins present in the portal venous blood originating from either the spleen or the gastrointestinal tract.

The hepatic arterial vasodilator properties of glucagon in the sympathetically-denervated liver have been reported previously (Richardson & Withrington, 1975, 1976). Normally it enters the liver in the portal blood, its origin being the alpha cells of the pancreatic islets although an immunoreactive glucagon-like material is found to be released from the gut (Bloom, 1974). Some glucagon passes through the liver and pulmonary circuits and re-enters the liver in the hepatic arterial supply. The hepatic arterial vascular responses to glucagon are complicated: injections into the hepatic artery provoke large and dose-dependent reductions in hepatic arterial resistance, the maximum response not being significantly less than to the other compounds tested. However, on a weight basis, it was the least potent of the agents examined and on a molar basis amongst the least active group. A striking observation, possibly with considerable functional significance, is that the duration of action of glucagon on the resistance vessels is very much longer than that of the others. The cumulative activity inherent in prolonged responses implies that glucagon, even in very small concentrations, will evoke sustained increases in liver blood flow. In addition to these direct actions of arterial glucagon on the hepatic arterial resistance is its inhibitory action on the hepatic vasoconstrictor responses to circulating agents such as noradrenaline, angiotensin and vasopressin (Richardson & Withrington, 1975; 1976) and adrenaline (Richardson & Withrington, unpublished observations). The relative importance of these two properties of glucagon in maintaining hepatic arterial blood flow is difficult to ascertain without more information on the circulating systemic arterial and portal blood concentrations.

Secretin is an established gastrointestinal hormone; its presence in the small intestine (Bayliss & Starling, 1902; Bloom, 1974) and its vascular actions (Ross, 1970) have been elucidated. It enters the liver in both portal venous and systemic arterial supplies. Injections of secretin into the hepatic artery result in profound dose-dependent hepatic arterial vasodilatation of very short duration. On a molar basis it is with prostaglandin E_2, the most potent vasodilator examined in the present series with an ED_{50} of 2.6×10^{-11} mol (80 ng; 1.28 u) and with vasodilatation of the hepatic arterial bed being apparent on intra-arterial injection of as little as 200 mu. Arterial or portal blood concentrations of secretin have not been satisfactorily established in experimental animals; in man normal peripheral blood secretin levels are of the order of 25 pg/ml rising to 250 pg/ml in starvation or when acid is present in the duodenum (Bloom & Ogawa, 1973; Boden & Chey, 1973; Bloom, 1974; Henry, Flanagan & Buchanan, 1975). In the present experiments, hepatic arterial vasodilatation was apparent on injection of 12.5 ng (200 mu) into an arterial blood flow of the order of 200–250 ml/min; it is therefore probable that hepatic arterial vasodilation occurs at physiological levels of secretin. In addition hepatic arterial vasodilatation is clearly elicited by arterial infusions of secretin which produce blood concentrations of 200–300 pg/ml (Richardson & Withrington, unpublished observations).

The results of the present experiments taken in conjunction with previous results (Richardson & Withrington, 1976) show that a number of substances which are present in the hepatic arterial supply have potent actions in either reducing (secretin and glucagon) or increasing (adrenaline, noradrenaline, angiotensin and vasopressin) hepatic arterial vascular resistance. The interaction between some of these substances is not, moreover, one of simple functional antagonism. In the case of glucagon it is considerably more complex (Richardson & Withrington, 1976). In addition, two of the vasodilator substances studied, histamine and prostaglandin E_2, although not normally present in the arterial supply in vasoactive amounts may enter the liver in the portal circulation. The extent to which these substances, and other vasoactive agents present in the portal vein, may modify the hepatic arterial vascular resistance and influence the actions of other vasoactive materials on the circulation is the subject of further experiments.

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A RAPID METHOD FOR THE ESTIMATION OF PROSTAGLANDIN 15-HYDROXYDEHYDROGENASE ACTIVITY AND ITS APPLICATION TO PHARMACOLOGY

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1 A novel double-isotope assay for prostaglandin 15-hydroxydehydrogenase (PGDH) is described.

2 The assay is simple, rapid, precise, completely specific for PGDH, and free from artefacts. The results obtained correlate well with a conventional assay.

3 The method is versatile, being applicable to estimations of enzyme activity in cell-free systems as well as perfused organs, and is well suited to the assay of PGDH inhibitors.

Introduction

Prostaglandin 15-hydroxydehydrogenase (PGDH) catalyses the initial (and probably rate-limiting) step in the metabolic degradation of prostaglandins (Änggård & Samuelsson, 1964, 1966; Hamberg & Samuelsson, 1971a). The enzyme is a soluble cytoplasmic protein which is widely distributed throughout animal tissues (Änggård, Larsson & Samuelsson, 1971) and has an important role in the metabolism of prostaglandins in animals and man (Gréen & Samuelsson, 1971; Hamberg & Samuelsson, 1971b, 1972). Oxidation of the C-15 alcohol group of prostaglandins, the reaction catalysed by PGDH, occurs extremely rapidly and results in a significant loss of biological activity (Änggård, 1966). The blood or tissue levels of prostaglandins at any given time should therefore be interpreted as the result of a balance between biosynthesis and PGDH activity. Thus PGDH is an important modulator of prostaglandin levels in biological fluids.

Recently we have demonstrated that PGDH has only a short life within the cell (half-life in rat kidney and lung, 45–75 min; Blackwell, Flower & Vane, 1975). Thus, activity depends upon continued enzyme synthesis and this could be very susceptible to hormonal control mechanisms; indeed several authors have now demonstrated alteration of enzyme activity following the administration to animals of steroids or bacterial endotoxins (Nakano & Prancan, 1973; Sun & Armour, 1974; Bedwani & Marley, 1975; Blackwell & Flower, 1976).

The key position in prostaglandin metabolism occupied by PGDH also makes it an interesting target for drugs. Recently it was shown that inhibitors of PGDH produced abortion in animals suggesting a role for this enzyme in the control of parturition (Lerner, Galliani, Carminati & Mosca, 1975) and also that blockade of lung PGDH in rabbits resulted in a significant prolongation of the biological activity of exogenously administered prostaglandins (Crutchley & Piper, 1975).

These factors make the activity of PGDH of considerable interest from the pharmacologist's viewpoint and we have therefore devised a novel method for the assay of PGDH, which can be used for estimation of enzyme activity in cell-free systems or perfused organs. The assay is simple, precise and rapid, and is well suited to the investigation of drug inhibitors of PGDH.

Methods

PGDH catalyses the oxidation of the C-15 alcohol group of prostaglandins and during this NAD$^+$-dependent reaction there is a concomitant loss of the C-15 hydrogen. The assay described here depends on the synthesis of prostaglandin $F_{2\alpha}$ specifically labelled with tritium at C-15, so that oxidation of this group by the enzyme results in a loss of tritium from the molecule (see Figure 1). After the PGDH reaction the mixture of labelled prostaglandins and unlabelled 15-keto metabolites is extracted from the reaction mixture with organic solvents leaving the ^{3}H label which has been removed by the enzyme in the aqueous phase. [1-^{14}C]-labelled prostaglandins are added as an internal standard since the label on these prostaglandins is not removed by PGDH. Metabolism can then be

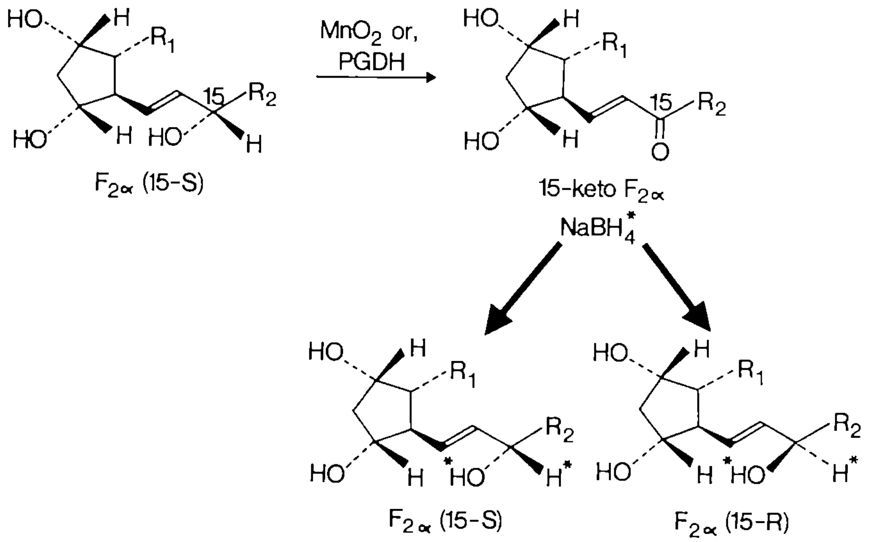


Figure 1 Preparation of the specifically labelled prostaglandin $F_{2\alpha}$. The groups 'R_1' and 'R_2' refer to the hydrocarbon chains appropriate to the bis-unsaturated prostaglandins. After the oxidation of prostaglandin $F_{2\alpha}$ (by MnO_2 or swine lung prostaglandin 15-hydroxydehydrogenase (PGDH)) the 15-keto derivative is reduced with [^{3}H]-$NaBH_4$ The reaction does not proceed stereospecifically and the products may have 'S' or 'R' configuration at C-15 In our hands the 15-R epimer predominates - Although two tritium atoms are incorporated into the molecule only the C(15)-H* tritium is stable The hydroxylic tritium C(15)-OH* is lost by rapid exchange with the solvent, ultimately therefore only monotritiated prostaglandins are formed.

estimated by calculating the ^{3}H/^{14}C ratio in the organic extract.

Preparation of specifically labelled prostaglandin $F_{2\alpha}$

The specifically labelled substrate [15-^{3}H]-prostaglandin $F_{2\alpha}$ is prepared from 15-keto prostaglandin $F_{2\alpha}$ by reduction with [^{3}H]-sodium borohydride.

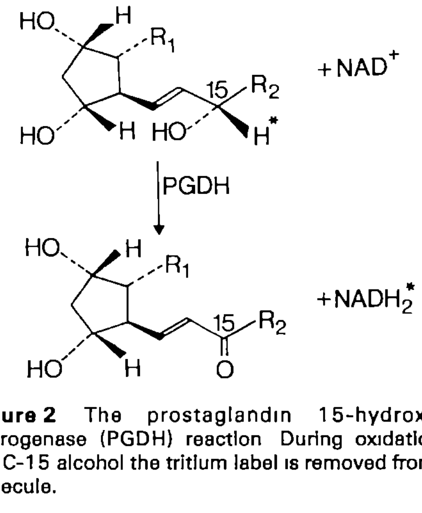
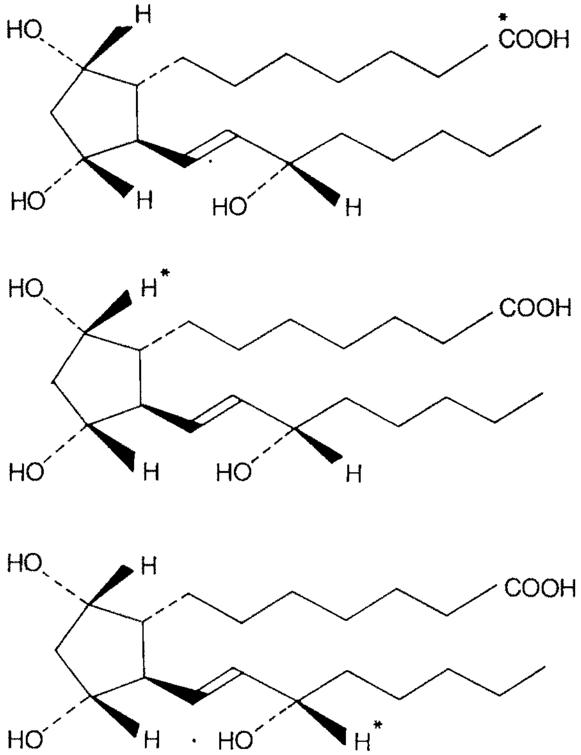


Figure 2 The prostaglandin 15-hydroxydehydrogenase (PGDH) reaction During oxidation of the C-15 alcohol the tritium label is removed from the molecule.

Unless authentic samples of 15-keto $F_{2\alpha}$ are available, the starting material must first be synthesized from prostaglandin $F_{2\alpha}$. This can be accomplished by oxidation of prostaglandin $F_{2\alpha}$ with manganese dioxide or by a biosynthetic route. In practice we found the latter approach superior because we experienced difficulty in specifically oxidizing the 15-OH group of prostaglandin $F_{2\alpha}$ with manganese dioxide. In most animal tissues the 15-keto metabolite of prostaglandins is rapidly metabolized by the enzyme PGΔ^{13}-reductase to another derivative. However, this enzyme is absent from swine lung (Änggård & Samuelsson, 1966) and we have therefore used homogenates of this tissue to prepare 15-keto prostaglandin $F_{2\alpha}$ biosynthetically. Fresh swine lungs were obtained from a local slaughter house and were stored in dry ice until used later the same day. Lung tissue (100 g) was trimmed free of connective tissue and homogenized in ice cold phosphate buffer (100 mM, pH 7.4) in the ratio of 4 : 1 (v/w) with a Waring blender. The resulting homogenate was filtered through cheesecloth and centrifuged at 100,000 g_{av} in a Beckman 'Spinco' ultracentrifuge for 1 hour. The resulting supernatant (which contains PGDH) was decanted into an Erlenmeyer flask and mixed with 2 mg of prostaglandin $F_{2\alpha}$. The cofactor for this reaction, β-NAD$^+$, was added to give a final concentration of 10 mM. After incubation at 37°C for 30 min the reaction mixture was acidified with 1 N HCl to pH 3. Saturating amounts of crystalline



1- $[^{14}C]$ $F_{2\alpha}$

9-$[^{3}H]$ $F_{2\alpha}$

15- $[^{3}H]$ $F_{2\alpha}$

Figure 3 Three different types of specifically labelled prostaglandin $F_{2\alpha}$ molecules used in this study

NaCl were added (to prevent emulsion formation) and the mixture was extracted with an equal volume of ethyl acetate. After phase separation this organic phase was dried in a rotary evaporator, the residue taken up in 100 µl chloroform–methanol (1 : 1) and streaked (1 cm) onto a silica gel thin layer chromatogram which was subsequently developed to a distance of 20 cm in *iso*-octane, ethyl acetate, acetic acid, water (5 : 11 : 2 : 10). After development the plate was dried and the zones containing prostaglandin $F_{2\alpha}$ and its 15-keto metabolite were located by exposure to iodine vapour. Prostaglandin $F_{2\alpha}$ has an R_F value of about 0.13 in this system and 15-keto prostaglandin $F_{2\alpha}$ an R_F of about 0.27. In order to remove traces of 15-keto prostaglandin $F_{1\alpha}$ which might have been formed from endogenous prostaglandin $F_{1\alpha}$ and which would co-chromatograph with 15-keto-prostaglandin $F_{2\alpha}$, it was necessary to rechromatograph the product on a silica gel plate impregnated with 5% $AgNO_3$. The same solvent system was utilized, the approximate R_F value of 15-keto prostaglandin $F_{2\alpha}$ being 0.19. The final product was eluted from the plate, dissolved in ethanol and stored at −20°C. Yields of up to 1 mg of 15-keto prostaglandin $F_{2\alpha}$ have been obtained in this way.

Reduction of 15-keto prostaglandin $F_{2\alpha}$ with [^{3}H]-sodium borohydride

In a typical preparation, 0.5 mg of 15-keto prostaglandin $F_{2\alpha}$ was dissolved in 0.5 ml absolute ethanol in a small glass tube and placed in an ice bath. Approximately 80 mCi [^{3}H]-sodium borohydride was transferred to a small hand-held homogenizer containing 0.5 ml cooled ethanol. The particle of sodium borohydride was then disintegrated in the ethanol and the resulting partial solution added to the sample in the ice bath. This reaction must be performed in a fume cabinet since tritium is liberated.

After 30 min, 5 ml water was added and 0.1 ml 1 N HCl. This acidification decomposes the unreacted [^{3}H]-sodium borohydride with concomitant liberation of labile tritium, and protonates the prostaglandin products so that the sample can then be extracted by shaking with ethyl acetate (5 ml). After the organic layer was removed it was evaporated to dryness and applied to a silica gel t.l.c. plate which was developed in the solvent system already described. After development, the plate was briefly dried and the zones containing radioactivity were located with a radiochromatogram scanner. Two main zones of radioactivity were seen, one of which corresponded to the authentic prostaglandin $F_{2\alpha}$ standard (R_F 0.13). The chemical reduction of 15-keto prostaglandin $F_{2\alpha}$ does not proceed stereospecifically (see Figure 3) and as well as the naturally occurring 15-S configuration, the 15-R epimer is also found (R_F 0.24) often in larger amounts than the 15-S compound. The 15-R compound is not a substrate for the enzyme.

When fresh [^{3}H]-sodium borohydride was used a very small amount (< 10%) of the radioactivity recovered was found at the origin of the t.l.c. plate. In aged preparations this residual activity may account for 50–60% of the radioactivity recovered; it is apparently a [^{3}H]-sodium borohydride decomposition product. For this reason only fresh preparations of the reducing agent should be used. The batch of [15-^{3}H]-prostaglandin $F_{2\alpha}$ prepared for this study by the method outlined above had a specific activity of 1.34 mCi/mmol. The product was mixed with [1-^{14}C]-labelled prostaglandin $F_{2\alpha}$, and unlabelled prostaglandin $F_{2\alpha}$ and dissolved in ethanol giving a final solution containing 2.7 µg/ml prostaglandin $F_{2\alpha}$ and 5.2×10^6 d/min ^{3}H and 5.5×10^5 d/min ^{14}C/ml. The solution was stored at −20°C until required.

Preparation of cell-free system containing prostaglandin 15-hydroxydehydrogenase

Rat kidneys were chosen as a convenient source of PGDH for routine purposes, and the 100,000 *g* supernatant was prepared as follows: rats (male, Wistar strain, weighing between 150–250 g) were killed by a blow on the head. The kidneys were removed, immediately placed on ice and homogenized within 5 min in 5 vol of ice-cold buffer (100 mM pH 7.5 Tris). The resultant suspensions were then centrifuged at 100,000 g_{av} in a Beckman 'Spinco' ultracentrifuge. The resultant pellet was discarded, and the supernatant, which contained PGDH, was used for assays of prostaglandin metabolism. The supernatant was stored on ice until required for use since enzyme activity was very labile; when kept at room temperature, about 50% activity was lost within 30 min of centrifugation.

Estimation of prostaglandin $F_{2\alpha}$ metabolism by 'single isotope' technique

The results obtained by the double-isotope technique described here were compared with a well established technique for measurement of PGDH activity.

We have employed a radiochromatographic method with [9-^{3}H]-prostaglandin $F_{2\alpha}$ as a substrate.

Reaction sets for this assay comprised the following components: 100,000 *g* supernatant, 1 ml; NAD$^+$, 756 pmol; [9-^{3}H]-prostaglandin $F_{2\alpha}$, 0.1 µCi; unlabelled prostaglandin $F_{2\alpha}$, 75.6 pmol. After the contents were thoroughly mixed the tubes containing the reaction mixture were incubated in a shaking waterbath at 37°C for various time periods. Inhibitory drugs were added as required. The reaction was terminated by boiling for 1 min, and acidifying the mixture to pH 3 with 1 N HCl. The unreacted prostaglandin $F_{2\alpha}$ and its metabolites were extracted by 'vortex' mixing the preparation for 30 s with 1.5 ml of ethyl acetate. This procedure consistently extracts more than 95% of labelled products. After mixing, the phases were separated by centrifugation, 1 ml of the organic layer was removed and mixed with 5 µg each of unlabelled prostaglandin $F_{2\alpha}$ and 15-keto-prostaglandin $F_{2\alpha}$. The organic solvents were removed in a vacuum desiccator and the dried residue redissolved in 50 µl of ethanol and spotted quantitatively onto a plastic-backed silica gel t.l.c. plate. After development in the solvent system already described, the plates were dried and zones corresponding to authentic prostaglandin markers were visualized by brief exposure to iodine vapour and cut out with scissors. After spontaneous evaporation of the iodine, the radioactivity in each zone was estimated by liquid scintillation counting.

Estimation of prostaglandin $F_{2\alpha}$ metabolism by the 'double isotope' technique

When the double isotope technique was used, reaction sets were prepared in an identical fashion to those for the single isotope method except that the substrate was a mixture of the [1-^{14}C]-prostaglandin $F_{2\alpha}$ and the [15-^{3}H]prostaglandin $F_{2\alpha}$; 10 µl of the ethanol mixture was used per reaction set.

After incubation, the samples were processed as before, except that the sample was extracted with 1 ml ether. After centrifugation in a bench centrifuge (to facilitate phase separation) convenient aliquots of ether were transferred into scintillation counting vials. The solvent was removed under a stream of N_2, in a vacuum aspirator, or was allowed to evaporate spontaneously. When dry, 10 ml of scintillation counting fluid was added to each vial and the ^{3}H/^{14}C ratio estimated.

Liquid scintillation counting procedures

The radioactivity in the samples was estimated with a Beckman LS-150 liquid scintillation counter. The scintillation counting fluid used was Beckman 'Cocktail D': 5 g PPO and 100 g naphthalene per litre dioxane. The double-isotope method depends on accurate counting so all samples were counted such that $2\sigma \ngtr 0.5\% \bar{x}$. All ct/min values were converted to d/min by the AES ratio method. The ^{14}C 'spillover' into the ^{3}H channel and appropriate correction to obtain the true ^{3}H d/min was calculated by a conventional method with an Olivetti P602 computer.

Calculation of results obtained by the double-isotope method

The $^3H/^{14}C$ ratio in boiled 'control' samples was arbitrarily set at 1.000 and the isotope ratios of the 'experimental' samples normalized accordingly. The amount of prostaglandin $F_{2\alpha}$ oxidized is then given by the formula:

$$\text{Units prostaglandin } F_{2\alpha} \text{ oxidized} = \left(1 - \frac{^{3}\text{H d/min}}{^{14}\text{C d/min}}\right)$$

$$\times \text{ Units prostaglandin } F_{2\alpha} \text{ in reaction mixture.}$$

where '^3H d/min' and '^{14}C d/min' refer to the experimental sample. In this paper these values are corrected for protein content of sample and/or incubation time.

Students *t* test (independent) was used for statistical analysis of significance.

Reagents and drugs

The following compounds were used: cycloheximide, *N*-ethyl maleimide and β-NAD$^+$ (Sigma); ethacrynic acid and indomethacin (Merck, Sharpe & Dohme); diphloretin phosphate (Leo); frusemide (Hoechst); [9-^3H]-prostaglandin $F_{2\alpha}$, batch 6, 15 Ci/mmol, and [^3H]-sodium borohydride, batch 38, 271 mCi/mmol (Radiochemicals, Amersham); [1-^{14}C]-prostaglandin $F_{2\alpha}$, cat no. 769-213, 52.5 mCi/mmol (New England Nuclear); unlabelled prostaglandin $F_{2\alpha}$ (Cambrian Chemicals); type 6060 Silica gel plastic backed t.l.c. plates (Eastman Kodak); glass-backed silica gel t.l.c. plates (Anachem). All other reagents were of 'Analar' grade, or the highest purity obtainable.

Results

Change in $^3H/^{14}C$ ratio during incubation with rat kidney supernatant

In the first set of experiments the $^3H/^{14}C$ ratio of (extracted) prostaglandins in the ether extract of rat kidney supernatant was measured at different times. Figure 4 shows the fall in $^3H/^{14}C$ ratio which was observed. The loss of ^3H was linear for up to 4 min after which the reaction rate began to decline. The enzyme is completely specific for the 'S' configuration of the 15-OH group (Nakano, Änggård & Samuelsson, 1969) and the specifically labelled 15-R-prostaglandin $F_{2\alpha}$ was not oxidized.

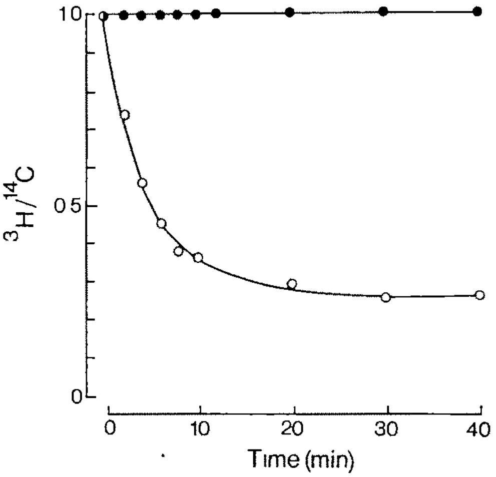


Figure 4 Decline with time of the $^3H/^{14}C$ ratio of extracted prostaglandin $F_{2\alpha}$ incubated with rat kidney prostaglandin 15-hydroxydehydrogenase (PGDH) preparations. Only the 15-S-epimer (O) is oxidized. Each point on the 15-S-$F_{2\alpha}$ curve is a mean of five observations, and each point on the 15-R-$F_{2\alpha}$ curve (●) is a mean of two observations. The s.e. mean values are too small to show on the graph and have been omitted

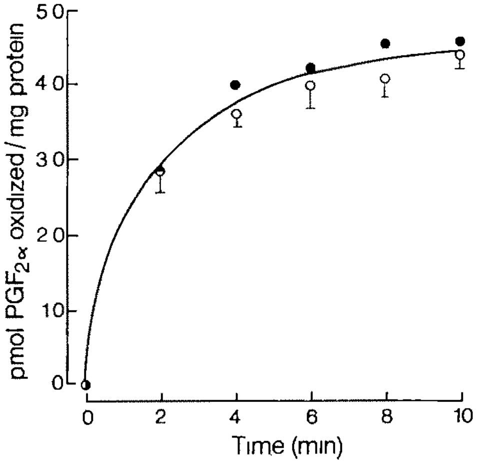


Figure 5 A comparison between the single (O) and double (●) isotope methods for estimation of prostaglandin oxidation in rat kidney. Each point is the mean of five observations. The s.e. mean values for the double-isotope assay are too small to show on the graph and have been omitted (but see Table 1).

Comparison of 'single' and 'double isotope' methods for estimation of prostaglandin metabolism

During the reaction catalysed by PGDH the C-15 alcohol group must bind to the enzyme and the C(15)-H bond must be broken. In this assay the C(15) hydrogen of prostaglandin $F_{2\alpha}$ is replaced by a tritium atom. Because of the greater mass of the tritium atom, the specifically labelled prostaglandin $F_{2\alpha}$ might not bind to, or be oxidized by, the enzyme

Table 1 Comparison of double isotope and single isotope estimations of PGDH in rat kidney

	Single isotope method	Double isotope method
Readings obtained (pmol F$_{2\alpha}$ oxidized/mg protein)	3.624 4 781 4 242 3 957 3 406	4 566 4 354 4 538 4.522 4.369
Mean	4.002	4.469
Standard deviation	0 539	0 100
Standard error	0.241	0 044
Range	3 406–4.781	4.354–4 566

in exactly the same manner as the native molecule, thus giving rise to spurious results. To exclude the possibility of such a 'kinetic isotope effect' the results obtained by the double isotope method were compared with those compared with a conventional single isotope radiochromatographic technique.

Figure 5 shows the rate curves obtained with the two methods; there is no statistical difference between the results obtained by either technique. Table 1 is an analysis of the data at one time point (8 min) on both curves. Inspection of the double isotope data shows the standard deviation and standard error of the double isotope assay is considerably smaller than that of the single isotope assay; the range is also much smaller. However, there is very good overall agreement between the two methods, and the difference between the two sets of results is not statistically significant.

Table 2 Data (mean ± s.e mean) for β-oxidation experiment

Incubation time (min)	*$^{14}C/^{3}H$ ratio*
Non-incubated control	1.000
5	1.056 (±0.010)
10	1.010 (±0.006)
15	1.037 (±0.010)
20	1.033 (±0.023)
25	1.063 (±0.013)
30	1.008 (±0 008)

β-Oxidation experiment

Prostaglandins and their metabolites are further oxidized *in vivo* by the fatty acid β- and ω-oxidation systems (Samuelsson, Granström, Gréen & Hamberg, 1971; Johnson, Davison & Ramwell, 1972). When metabolized by β-oxidation systems the carboxylic side chain of prostaglandins is successively degraded in a stepwise fashion finally yielding tetranorprostane derivatives. If such a process occurred in tissue homogenates during measurement of metabolism by the double-isotope method the internal standard [1-^{14}C]-prostaglandin F$_{2\alpha}$ would lose its [1-^{14}C] label and again spurious results could be obtained. To discover whether this effect obtains under the circumstances of our assay we measured the ratio between [1-^{14}C]-prostaglandin F$_{2\alpha}$ and a titrium

Table 3 Effect of pretreatment with cycloheximide on prostaglandin F$_{2\alpha}$ metabolism in rat kidney: comparison of assays

Group	*Single isotope*			*Double isotope*	
	F$_{2\alpha}$ metabolized (pmol)	*% Inhibition*	*$^{3}H/^{14}C$ ratio*	*F$_{2\alpha}$ metabolized (pmol)*	*% Inhibition*
Control (n=2)	5.461	—	0 776	6 286	—
Cycloheximide (n=2)	1.096	79.93	0.949	1.422	77.4

labelled species of prostaglandin $F_{2\alpha}$ ([9-^{3}H]-prostaglandin $F_{2\alpha}$) in which the tritium label would not be removed enzymatically; thus if β-oxidation were occurring there would be a fall in the $^{14}C/^3H$ ratio. β-Oxidation probably occurs in microsomes so we used unseparated kidney homogenates in these experiments. Although metabolism plateaus after 6–8 min (see Figure 3) we measured the $^{14}C/^3H$ ratio for up to 30 min (see Table 2) but found no fall in the $^{14}C/^3H$ ratio.

Effect of pretreatment of rats with cycloheximide

Tissue activity of PGDH in rat kidneys declines rapidly after treatment with the protein synthesis inhibitor cycloheximide (Blackwell *et al.*, 1975). In one experiment we estimated the fall in activity the administration of cycloheximide and compared the results obtained by both 'single' and 'double isotope' assays. Each rat received cycloheximide (20 mg/kg) and was killed 2 h later. The kidneys were removed and processed, and metabolism estimated as already described. Table 3 shows that the rate of control metabolism and the decline following cycloheximide when measured by the double-isotope methods were in very good agreement with rates obtained using the single isotope method.

Measurement of the effect of inhibitors of prostaglandin 15-hydroxydehydrogenase

The applicability of the double-isotope method to the study of inhibitors was tested with five drugs, frusemide, ethacrynic acid, *N*-ethyl maleimide, indomethacin and diphloretin phosphate, all of which have been previously shown to affect PGDH activity (Paulsrud & Miller, 1974; Crutchley & Piper, 1974). All drugs except *N*-ethyl-maleimide showed high activity against the enzyme at 1 mM, the descending order of potency being, diphloretin phosphate, frusemide, indomethacin, and ethacrynic acid. The inhibition by *N*-ethyl maleimide (1.57%) was not significant.

Measurement of prostaglandin metabolism by perfused lungs

In one experiment we compared the double-isotope method with bioassay as a measurement of prostaglandin $F_{2\alpha}$ metabolism in perfused lungs. Guinea-pig lungs were perfused with Krebs solution (10 ml/min) through the pulmonary artery (Piper & Vane, 1969). The effluent from the lungs superfused a rat stomach strip and a rat colon in cascade (Ferreira & Vane, 1967). Injections of 4 μg prostaglandin $F_{2\alpha}$ containing the labelled species were made into the pulmonary artery, and the contractions produced by the unmetabolized prostaglandin $F_{2\alpha}$ in the effluent were matched by injections of authentic prostaglandin $F_{2\alpha}$ directly over the tissues. In addition, the lung effluent was collected and the ratio of $^3H/^{14}C$ prostaglandin $F_{2\alpha}$ estimated as described. With the double-isotope assay the metabolism of prostaglandin $F_{2\alpha}$ was estimated as 71% during a single passage through the lungs. With the rat fundic strip as an assay organ, metabolism was estimated as 57%, but on the rat colon (a more reliable assay organ for prostaglandin $F_{2\alpha}$ than the fundic strip), metabolism was estimated at 71%; an extraordinarily close correlation with the radio isotope method.

Discussion

The double isotope assay which has been developed for the estimation of PGDH activity has the advantages of simplicity, complete specificity, rapidity and sensitivity. It is free from artefacts due to β-oxidation or kinetic isotope effects. The results obtained with the assay showed excellent agreement with those obtained by a conventional radiochromatographic method. We believe the assay to be superior in specificity, precision or sensitivity to other existing methods for estimating PGDH activity such as the spectrophotometric determinations of 15-keto metabolites or of $NADH_2$ generation (see Änggård,

Table 4 Data (mean ± s.e. mean) for inhibition of rat kidney prostaglandin 15-hydroxydehydrogenase (PGDH) by drugs (1 mM). ($n = 5$)

Group	*$^3H/^{14}C$ ratio*	*$F_{2\alpha}$ oxidized (pmol)*	*% Inhibition*
Control	0.531 (±0.024)	35 13 (±1.83)	—
Frusemide	0.926 (±0.008)	5.47 (±0.64)	84.44 (±1.82)
Ethacrynic acid	0.804 (±0.031)	16.88 (±0.49)	51.95 (±1.39)
N-ethyl maleimide	0.537 (±0.025)	34.58 (±1.89)	1.57 (±5.40)
Indomethacin	0.882 (±0.005)	8.74 (±0.45)	75.13 (±1.37)
Diphloretin phosphate	0.973 (±0.007)	3.44 (±0.96)	90.24 (±2.74)

1971) or the radiochromatographic method we have also described in this paper.

Amongst the disadvantages of the assay are the expense of the radioisotopes, the need to synthesize the specifically labelled substrate from a starting material which may be difficult to obtain, and the necessity for careful double-isotope counting. Perhaps the major drawback is that only prostaglandin $F_{2\alpha}$ can be used as a substrate in this assay; this is because the 9-keto group of prostaglandin E_2 would also be reduced together with the 15-keto group so that it is not easily possible to prepare specifically labelled prostaglandin E_2 in the same straightforward way in which prostaglandin $F_{2\alpha}$ may be prepared. However, both prostaglandin E_2 and $F_{2\alpha}$ are good substrates for the enzyme, the relative reaction rates on the swine lung enzyme being 97% (of prostaglandin E_1 rate) for prostaglandin E_2 and 62% for $F_{2\alpha}$, (Änggård & Samuelsson, 1966).

The method is suitable for the screening of inhibitors of the enzyme and we would expect this to be a major application; that it is also suitable for the measurement of metabolism in perfused organs confirms its versatility and suggests new ways of using the technique. For example, we have recently shown that the assay is applicable to the estimation of metabolism *in vivo* (Blackwell & Flower, unpublished). By giving intravenous injections of the isotopes into anaesthetized rats and taking small serial blood samples from a catheter in the aorta it is possible to estimate rapidly and accurately the amount of prostaglandin $F_{2\alpha}$ metabolized at any time.

It is possible that PGDH will emerge as a major determinant of blood/tissue levels of prostaglandins and that the assay described here will be an extremely useful tool for the measurement of its activity both *in vitro* and *in vivo.*

We wish to express our gratitude to Dr K. Crowshaw for a sample of authentic 15-keto-$F_{2\alpha}$ (Ono) and to Ms A. Harvey for performing the bioassays.

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OBSERVATIONS ON THE PHARMACOLOGY OF CHOLINOCEPTIVE NEURONES IN THE RAT BRAIN STEM

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1 The pharmacology of spontaneously active cholinoceptive neurones in the brain stem of rats anaesthetized with urethane has been investigated using microiontophoresis to administer muscarinic and nicotinic agonists and antagonists.

2 Acetylcholine (ACh) excited most cells but occasionally depressed their activity. Muscarine, and the muscarinic agonists methacholine and bethanechol produced prolonged excitation or inhibition of cells whereas nicotine produced prolonged excitations but no inhibitions.

3 Atropine selectively antagonized ACh excitations and both excitation and inhibition of neuronal activity produced by muscarine and muscarinic agonists, but not the excitations produced by nicotine, glutamate or DL-homocysteic acid.

4 Dihydro-β-erythroidine (DHBE) and tubocurarine antagonized both ACh and nicotine excitations but not those induced by glutamate or DL-homocysteic acid. Inhibitions by ACh or muscarine were not affected.

5 It is concluded that excitations of cholinoceptive neurones in the rat brain stem may be mediated by activation of both muscarinic and nicotinic receptors whereas inhibitions are mediated by activation of a muscarinic receptor.

Introduction

The firing rates of single neurones in the brain stem of the rat can be increased or decreased by microiontophoretically applied acetylcholine (ACh) (Bradley & Dray, 1972; 1973; Duggan, Headley & Lodge, 1974). However, although the pharmacology of these responses is known for the cat, little is known about their pharmacology in the rat, although it has been reported that ACh excitation of medullary neurones shows a different susceptibility to nicotinic receptor antagonists in different anaesthetic states (Duggan *et al.*, 1974).

In the present study, the responses of rat medullary neurones to iontophoretically applied ACh and other cholinomimetics have been compared and their interactions with cholinoceptor antagonists evaluated.

Methods

Adult albino rats were anaesthetized with urethane (1.3–1.8 g kg^{-1}, i.p.) and prepared for brain stem recording by the method previously described (Bradley & Dray, 1973). One barrel of a multibarrelled glass micropipette was used to record the extracellular activity of single spontaneously active neurones in the medulla. Other barrels contained aqueous solutions of the drug for electrophoresis onto the neurone being studied. The ejection of Na$^+$ was used as a control for current effects. Recordings were made by conventional methods. The effects of muscarine, methacholine, bethanechol or nicotine were compared on neurones which responded reproducibly to ACh. Studies with the antagonists atropine, dihydro-β-erythroidine (DHBE) or tubocurarine were made on cells which responded submaximally but consistently to applications of ACh and other agonists.

The following drugs were used in this study: acetylcholine chloride, 0.3–0.6 M, pH 4.0–5.0 (Hopkin and Williams, B.D.H. or Sigma); monosodium glutamate, 0.2 M, pH 8.0–9.0 (L. Light & Co.); DL-homocysteic acid, 0.2 M, pH 8.0–9.0 (Koch-Light); nicotine or nicotine hydrogen tartrate, 0.6 M, pH 3.0–4.0 (BDH Ltd); acetyl-β-methylcholine chloride (methacholine), 0.5 M, pH 4.0–5.0 (Koch-Light); β-methylcholine carbamate chloride

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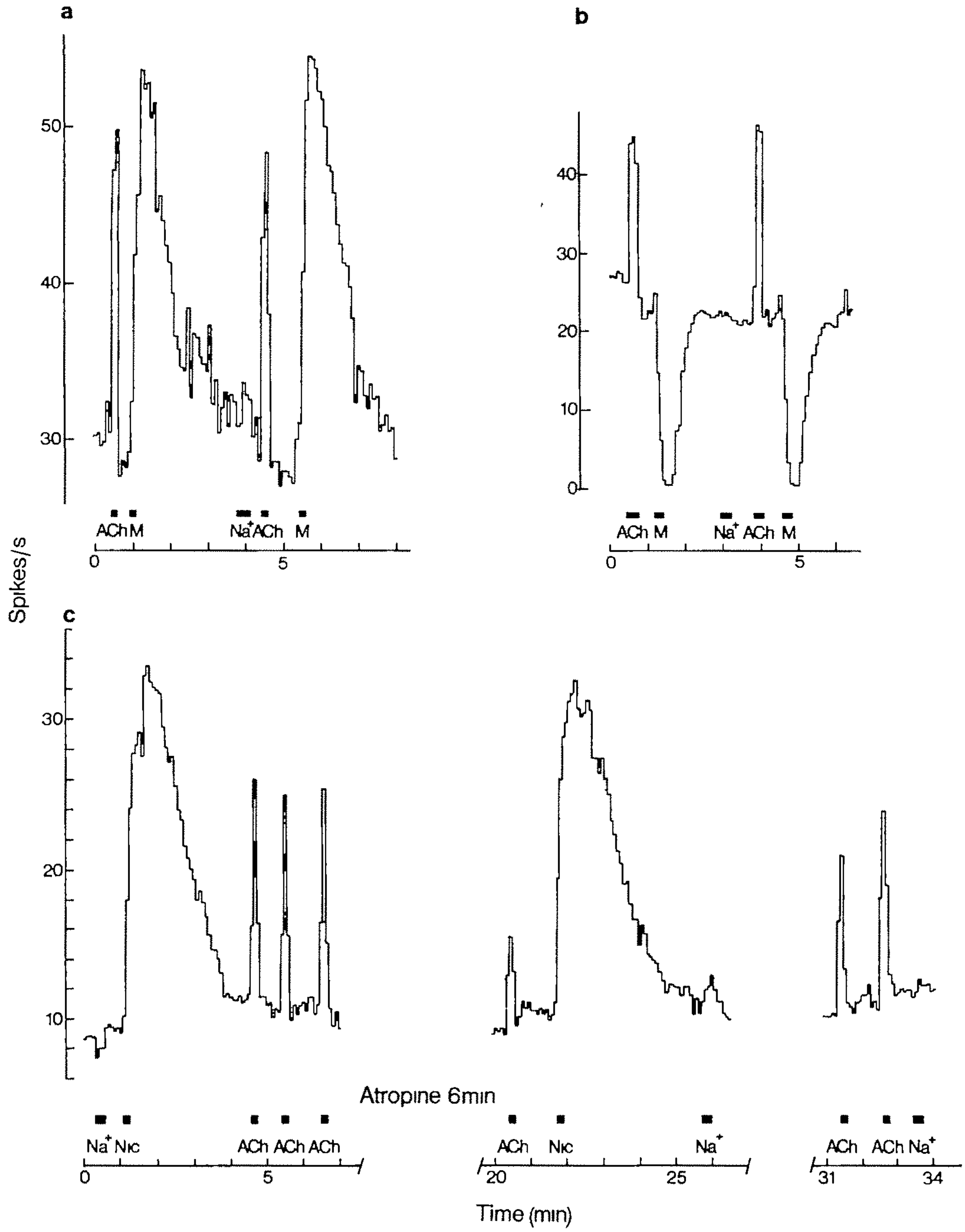

Figure 1 Histograms of neuronal firing rate (spikes/s against min) showing (a) excitatory responses to acetylcholine (ACh) and muscarine (M); (b) excitation by acetylcholine but inhibition by muscarine, (c) selective reduction of acetylcholine but not nicotine (Nic) excitation by atropine (10 nA) and subsequent recovery. All agonist expelling currents were 50 nA.

(bethanechol), 0.5 M pH 4.0–5.0 (Martindale Samoore Ltd); atropine sulphate, 0.03–0.06 M, pH 5.0–6.0 (BDH Ltd); dihydro-β-erythroidine, 0.08 M, pH 4.0–5.0 (Merck, Sharp & Dohme); (+)-tubocurarine chloride, 0.02 M, pH 4.0–5.0 (Burroughs Wellcome & Co); (+)-muscarine iodide, 0.3 M, pH 4.0–5.0 (gift from Prof. A. Herz).

Results

Most cells were excited (241/295) by ACh (5–50 nA for 5–15 s) though some were inhibited (20/295). Two types of excitatory response could be distinguished on the basis of the latency of onset; an excitation of short latency (0.2–0.8 s), and less frequently (49/295) an excitation of longer latency (5–20 seconds). Inhibition by ACh occurred after a relatively short latency (5 s) and rarely outlasted the period of ejection.

Desensitization of ACh excitation was not normally observed, but could be produced during a prolonged administration (1–2 min) of ACh or occasionally by a prior administration of nicotine. No desensitization of ACh inhibition was observed.

Muscarine, methacholine and bethanechol (15–50 nA) excited or inhibited cells but these responses were not always in the same direction as ACh responses (Table 1). It was notable that these muscarinic receptor agonists depressed cell activity more frequently than did ACh (Figure 1b). Responses to these agents were usually more prolonged than the responses to ACh (Figure 1a and b).

Nicotine (15–50 nA) excited most cells (Table 1) and these responses were more prolonged than ACh excitation of the same neurones (Figure 1c). Desensitization to nicotine excitation was sometimes observed but especially when the period between repeated ejections was short. Although nicotine was never observed to depress neurones, there was a notable increase in the number of cells inhibited by ACh when nicotine had been tested.

Prolonged applications of atropine (10–50 nA for 1–10 min) depressed neuronal firing (15/50) but occasionally increased it (2/50). Excitation by ACh was selectively reduced by atropine (48 of 50 cells) (Figure 1c). In addition both excitation and inhibition by muscarine (7/7 excitations; 5/5 inhibitions) or methacholine (10/10 excitations; 1/1 inhibition) were antagonized, but excitations by nicotine (0/12), glutamate (0/15) or DL-homocysteic acid (0/11) were unaffected.

DHBE (50–75 nA for 1–10 min) and tubocurarine (10–50 nA for 1–10 min) produced changes in cell firing. Thus 5 of 18 cells were excited and 3 depressed by DHBE and 4 of 7 cells were excited by tubocurarine. Both ACh (10/17) and nicotine excitation (10/14) were selectively reduced by DHBE. However, neither inhibition by ACh (1 cell) or muscarine (5 cells), nor excitation by glutamate (9 cells) or homocysteic acid (7 cells) were affected. Tubocurarine selectively reduced ACh (2/5) and nicotine (3/8) excitation but not that to homocysteic acid (0/5).

Discussion

In the present experiments, most (88%) spontaneously active medullary neurones were cholinoceptive, 80% being excited and a smaller proportion (8%) inhibited by ACh. Similar responses have been reported and described in detail from other studies in rats (Bradley & Dray, 1972, 1973; Duggan *et al.*, 1974). However, these findings differ from those obtained in the cat, where the number of cholinoceptive neurones appears to be smaller (< 50%) but a higher proportion (22%) are inhibited (Avanzino, Bradley & Wolstencroft, 1966; Bradley, Dhawan & Wolstencroft, 1966).

Muscarine, methacholine and bethanechol generally produced responses in the same direction as ACh. However these substances inhibited neurones more frequently than did ACh. Nicotine, however, only excited neurones. Acetylcholine inhibition was observed more frequently during testing with nicotine, suggesting that possible desensitization of excitatory receptors by nicotine allowed the ACh activation of inhibitory receptors to predominate. Responses to nicotine and to muscarinic agonists were more prolonged than those to ACh and this may be explained by differences in the efficiency of inactivation of these substances.

Desensitization of ACh excitation has been reported previously (McCance, Phillis & Westerman,

Table 1 Summary of the effects of muscarine, methacholine, bethanechol and nicotine on cells on which acetylcholine was also tested

		Muscarine			*Methacholine*			*Bethanechol*			*Nicotine*		
		+	O	–	+	O	–	+	O	–	+	O	–
Acetylcholine	+	37	1	19	41	13	9	44	7	12	37	5	0
	O	1	4	4	0	4	1	2	10	0	4	1	0
	–	0	0	0	0	0	0	0	0	9	10	1	0

Figures refer to the number of cells studied += excitation; O = no effect; – = inhibition.

1968; Tebēcis, 1970) and was observed in the present study only after prolonged administration of ACh or after a prior administration of nicotine but not muscarinic receptor agonists. Furthermore, inhibition of cell firing was only observed with ACh and muscarinic agonists but not with nicotine and this response did not desensitize. This suggests that desensitization is more closely related to actions involving nicotinic receptors.

Atropine selectively antagonized the excitatory effects of ACh as well as excitation and inhibition by muscarine and methacholine. Nicotine, glutamate or homocysteic acid excitation were unaffected by atropine. Such interactions provide additional evidence for the presence of excitatory and inhibitory muscarinic receptors.

DHBE selectively anatagonized some ACh excitations as well as those by nicotine. However, inhibition by ACh or muscarine was unaffected, and neither was excitation by excitant amino acids. In addition tubocurarine antagonized nicotine and ACh excitation but not excitation by homocysteic acid. It appears therefore that the receptors on cholinoceptive medullary neurones in the rat are similar to those found in the cat (Bradley *et al.*, 1966) and possess both nicotinic and muscarinic properties (Duggan *et al.*, 1974). Excitation may be mediated by activation of both types of receptor while inhibitions are mediated by activation of muscarinic receptors.

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NORADRENALINE MODULATION OF THE RESPONSES OF THE CEREBELLAR PURKINJE CELL TO AFFERENT SYNAPTIC ACTIVITY

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Noradrenaline, applied by microiontophoresis to rat cerebellar Purkinje neurones, selectively depressed spontaneous neuronal discharge. Simple spike and complex spike excitations, evoked by stimulation of the mossy and climbing fibres, were relatively preserved during the inhibition of spontaneous activity, and the number of full-sized action potentials in the complex spike increased. Inhibition mediated by the basket and stellate cells was augmented. Thus, relative to the change in spontaneous activity, noradrenaline increased the responsiveness of the Purkinje cell to afferent input.

Introduction Demonstration of catecholamine-containing fibres in the cerebellar cortex suggested the presence of previously unknown cerebellar afferent fibres (Hokfelt & Fuxe, 1969). Subsequent work has identified these fibres as a noradrenaline (NA)-containing pathway, originating in the nucleus locus coeruleus and synapsing on the Purkinje neurone (Olson & Fuxe, 1971; Bloom, Hoffer & Siggins, 1971). Physiological characterization of this pathway by stimulation of the locus coeruleus or application of NA by microiontophoresis has thus far shown that it depresses Purkinje cell spontaneous discharge, while hyperpolarizing the membrane and increasing its resistance (Hoffer, Siggins, Oliver & Bloom, 1973). However, many current formulations of cerebellar function emphasize integration of input from the mossy and climbing fibres as the most important role of the Purkinje cell. In the work presented here, therefore, we have examined the influence of NA on the activity evoked by stimulation of the other known afferents to the cerebellum. Specifically, complex spike excitation evoked by the climbing fibre, simple spike excitation evoked by mossy fibre activation of the granule cells and their parallel fibres, and inhibition evoked by the basket and stellate cells were each interacted with NA.

Methods Twenty Sprague-Dawley rats were anaesthetized with urethane (1.5 g/kg, i.p.) or halothane (1% in O_2). Five-barrelled micro-pipettes were used to record extracellularly from cerebellar Purkinje cells and to apply NA by microiontophoresis. The centre recording barrel was filled with 5 M NaCl; three side barrels were filled with NA (0.5 M, (–)-noradrenaline hydrochloride, pH 4.5) or γ-aminobutyric acid (GABA, 1.0 M, pH 4.0). Artifacts of iontophoretic current, pH, local anaesthesia, or failure to release drug were controlled, as previously described (Hoffer, Siggins & Bloom, 1971). Climbing and mossy fibres were activated by triple shocks (500 Hz) to the limbs, snout, or cerebral cortex (Allen, Azzena & Ohuo, 1974). 'Off beam' surface stimulation (single shock) was used to activate inhibitory basket and stellate cell inputs (Eccles, Ito & Szentagothai, 1967). Action potentials of single Purkinje cells, converted to constant voltage pulses by a gating circuit, were used by a digital computer to generate a post stimulus time histogram (PSTH). A control PSTH was computed for each cell to quantify the evoked and spontaneous activity. As shown in the examples of Figure 1, epochs of evoked and spontaneous activity were selected in the histogram, and the discharge rates in each were calculated by dividing the number of counts by the time and the number of sweeps. Subsequently, NA was applied by microiontophoresis. When a new steady state level of spontaneous discharge was reached, another PSTH was computed. Identical epochs in the control and NA histograms were then compared to quantify the percentage change in evoked and spontaneous activity (Freedman, Hoffer & Woodward, 1975). After cessation of NA administration, histograms were serially computed for demonstration of recovery of discharge rates to control levels.

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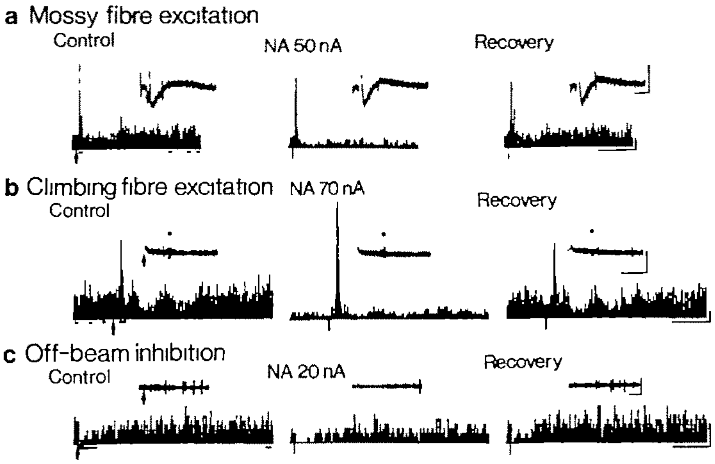

Figure 1 Effects of noradrenaline (NA) on cerebellar Purkinje neurones changes in evoked and spontaneous activity induced by NA. Post stimulus time histograms and extracellular action potential recordings are shown for control (left), NA iontophoresis (centre) and recovery (right) periods. Changes in evoked or spontaneous activity were computed by selecting portions of the histogram to correspond with each type of activity and comparing these same portions during control and NA iontophoresis periods. (a) For mossy fibre stimulation, the sharp peak several ms after the stimulus (arrow) represents simple spike excitation (solid line). A typical extracellular recording of such a response is shown in the insert. A 100 ms period, 400 ms after the stimulus, was chosen to represent the spontaneous activity (dotted line) of the cell. During NA ejection (50 nA), this spontaneous activity was nearly abolished. Comparison of identical periods in the control and NA iontophoresis histogram shows an 87% decrease, from 54.3 spikes per s to 7.2 spikes per second. However, the peak of simple spike excitation remained almost intact during NA ejections, an average of 0.95 spikes per stimulus were elicited, compared to 1.18 spikes during the control period, a decrease of only 19%. Stimulus parameters were three 7 V shocks to the cerebral cortex at 500 Hz every 250 milliseconds. Each histogram contains 100 sweeps. (b) The complex spike response to climbing fibre stimulation often was potentiated during NA iontophoresis. In the example shown, the evoked excitation (solid line) increased during NA ejection from 1.02 spikes to 1.52 spikes per stimulus. This potentiation is a result of an increase in the number of full-sized action potentials in the complex spike. In the control recording, the complex spike (dot) contains one full-sized spike with smaller wavelets. During NA ejection, the complex spike (dot) contains 3 full-sized action potentials. Simultaneously, the spontaneous activity, selected here to be prior to the stimulus, fell from 30.8 to 5.0 spikes per s, an 81% inhibition. Stimulation parameters were three 12 V shocks to the cerebral cortex at 500 Hz every 2 seconds. Each histogram contains 200 sweeps. (c) The effect of NA on inhibitory pathways was assessed during 'off beam' responses, obtained by stimulating the cerebellar surface. The resulting inhibition was quantified by selecting a response period (solid line), in a manner similar to that used for the study of excitation. During NA ejection, in the example shown, this inhibition was augmented by 90%, while spontaneous activity (dotted line) was depressed by only 45%. Stimulus parameters were one 5 V shock every 2 seconds. Each histogram contains 100 sweeps, each extracellular spike recording contains 5 superimposed sweeps. Calibration bars are 0.5 mV, 20 ms for all recordings and 5 counts per address, 100 ms for histograms

Results Mossy fibre activation is known to result in simple spike excitation of the Purkinje cell, with a latency of 5 to 10 ms (Allen *et al.*, 1974). An example is shown in Figure 1a. The initial peak in the histogram represents this excitation, which, after a brief period of inhibition, was followed by a return to a baseline spontaneous rate. During NA iontophoresis spontaneous discharge was inhibited profoundly, as previously observed (Hoffer *et al.*, 1971). However, simple spike excitation was much less affected. Spontaneous discharge was inhibited 87% in this case, but mossy fibre evoked spike activity was decreased only 19%. In all ten Purkinje cells similarly studied, spontaneous activity was depressed more than simple spike excitation.

Activation of the climbing fibre evokes a complex spike in the Purkinje cell, consisting of one or more full-sized action potentials, followed by smaller wavelets. In these experiments, PSTH's were computed with the gating circuit set to count only full-sized action potentials. As the inset spike record in Figure 1b (left) shows, generally there was only one such full-sized action potential in the complex spike. During NA iontophoresis, the spontaneous discharge rate again fell markedly, but evoked activity increased. Serial photographs of the complex spikes showed that although the number of evoked complex spikes decreased somewhat, the number of full-sized action potentials in each complex spike increased during NA administration (Figure 1b). Of the 20 cells studied, all showed greater inhibition of spontaneous activity than of complex spike evoked activity; in 8 cells the total number of full-sized action potentials evoked by the climbing fibre actually increased. On the average, spontaneous activity fell 72% while evoked activity increased 5%.

Stimulation of the cerebellar surface activates basket and stellate cells, which inhibit Purkinje cell discharge (Figure 1c). The inhibition was quantified by examining a selected response period following the stimulus, analogous to the manner by which the excitations were studied. Iontophoresis of NA potentiated 'off beam' inhibition by an amount greater than would be expected from the inhibition of spontaneous activity. In the example shown, inhibition increased by 90%, while spontaneous activity was inhibited only 45%. For ten cells similarly studied, augmentation of inhibition was 85%, while inhibition of spontaneous activity was only 63%. In several cases, marked augmentation of basket and stellate cell inhibition was seen at doses of NA which caused only minimal changes in spontaneous activity or at times when spontaneous discharge returned to normal following NA administration.

Discussion The effects of NA on cerebellar neuronal circuitry include actions which cannot be predicted from the simple inhibition of spontaneous activity. Despite the depression of spontaneous activity, simple spike excitation was preserved. Complex spike excitation was similarly preserved, and the number of full-sized action potentials increased. 'Off beam' inhibition was augmented. Thus, NA had a selective effect, preserving or enhancing afferent-evoked excitation and inhibition, while depressing spontaneous activity.

This study raises questions about the mechanisms responsible for the differential inhibitory action of NA and its implication for behaviour. A hypothesis that spontaneous discharge and receptivity to afferent input are affected differently because they are independent functions can be supported by studies which show spontaneous activity in cerebellum isolated from afferent input by lesion (Eccles *et al.*, 1967), transplantation (Hoffer, Seiger, Ljungberg & Olsen, 1974), or culture (Geller & Woodward, 1974). Further studies are required to determine the respective roles of the hyperpolarization and increased membrane resistance produced by NA in altering receptivity. It should be noted, however, that GABA, which hyperpolarizes but decreases membrane resistance, also increases responses to afferent excitatory input (unpublished observations). Findings similar to those reported here were seen with NA and auditory cortical neurones in monkey (Foote, Freedman & Oliver, 1975). Determination of the functional relevance of these effects of NA awaits further evidence from studies of adrenergic input in behaving animals.

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EDITORIAL

Mr. Preben Wolf's article is interesting in two directions. First, it deals briefly with the difference in crime rates according to degree of urbanisation where the Danish material confirms the prevailing view (see the most recent monograph by Professor Denis Szabo of the University of Montreal, "*Crimes et Villes*") that crime is more frequent in cities than in towns and rural districts, with the dividing line at 20,000 population. Secondly, Wolf discusses at far greater length the distribution of crime in Denmark according to social class. This is one of the most important subjects of the sociology of crime, but has been comparatively neglected in Britain and the Continental European countries with the exception of Denmark. Danish sociologists, especially Svend Ranulf, Geiger and Svalastoga, have done distinguished work on the sociology of class and class conflict, and it is not surprising that Danish criminologists, too, should turn their attention to it. As Wolf points out, the two-class concept of Karl Marx has long been superseded by much subtler distinctions, and he uses Svalastoga's nine-class system and the same author's sample of the Danish adult male population, giving the numbers of registered offences in each of the nine classes. The figures show, at least for offences against the Penal Code itself, a straight tendency to increase with declining social status. Moreover, the tendency to recidivate and the use of imprisonment also increase in the same direction, whereas the more lenient forms of social sanction were far more frequently used for offenders of higher social class. What is the explanation? Very cautiously, and with some reservations, the author accepts Merton's well-known theory of goals and opportunities.

At one time it was held in circles of dynamic psychology, perhaps particularly by some analysts, that classification placed a dead hand on the living who were subject to therapeutic attention. Where individuals are the sole concern of the therapist it is indeed true that in some measure the person is a closed self-regulating system whose motives and conflicts are to be understood and corrected in the confines of the consulting room or clinic. But if we attempt to relate persons to others, comparison and contrast become an obligatory scientific procedure and classification follows of necessity. The succession in scientific advance has always been from description to class-making and thence to causal relationships, and better still to the use of correlation without committing the material to a facile causal nexus.

Mr. Fitch's article is *prima facie* a descriptive-classificatory procedure in which the variables employed are subject to a simple statistical procedure which erects signposts to a further step in pragmatic classification. He shows how, through such a classification one advances to rational diagnosis and indications for differential treatment. So wide a behaviour character disorder as that of sexual offences cannot be hidden under a wide blanket made up of a patchwork of legal and social usages, indeed prejudices.

Psychopathology has indicated the ramifications of sex in mental emotional development, and therefore classing will be an important desideratum of penal changes. For example, Fitch shows how the difference between homosexual and heterosexual offences is determined not only by the character structure of the offender but by his social inclusions and the attitude of society itself. The one group would appear to be due to libidinal pressures of an almost normal kind, the other, the homosexual's offence, is more often more fundamental in its deviant structure. The community does insist on maleness and femaleness acting in pure culture as it were, casting a blind eye on the rich variety of transitional types amongst persons and of bisexual trends in the individual. Convictions show how differently the legal officers deal with the two main groups. Fitch brings out important differences at the primarily descriptive level, for example the important fact that the heterosexual offender is much more given to other forms of anti-social conduct. Yet society since Biblical times comes down most heavily on the homosexual, with of course the exception of offences ending in rape and murder. The heterosexual is more determined by changing social pressures and frustrations; the homosexual is relatively unchanging in the social scene.

The enquiry again brings into relief the importance of the psychopath, who is therapeutically the least tractable offender. His class analysis gives definite promise of predictive powers and therefore opens up avenues for differential penal awards and therapies. More important, the research shows clearly that the statistical and psychopathological approaches can go hand in hand; for only in some such combined operation can the individual be placed in the social or mass setting which the community will accept as a worth-while contribution to penal reform in its therapeutic aspect.

Dr. Allchin's paper on some positive aspects of delinquency is something of a portent and deserves the attention of those who are dissatisfied with the results of current multi-disciplined research on the subject: dissatisfied because the levels of approach are either too isolated or in too flagrant opposition. Throughout the past forty years the views of psycho-analysts on the causation of delinquent conduct, in which the accent has been laid on the symptomatic significance of anti-social behaviour, implying thereby that, for example, the difference between a psycho-neurosis and pathological types of delinquency lies in the psychic direction of the conflicting energies (i.e. whether they are externally or internally directed), has held a precarious authority in the field. In the meantime some psycho-analysts have been emboldened to expand this conflict hypothesis to include the adaptational aspects of delinquency in general. It is this approach to the subject which Dr. Allchin is concerned to underline. Following a suggestion made by Dr. Winnicott, he emphasises the positive and constructive aspects of delinquency. Its hopeful purpose, he maintains, is " to elicit a response from the environment," and he proceeds to indicate a possible existential basis of the situation, in particular the endeavour " to deal with a loss of feeling of reality and identity " and to avoid " the experience of weakness and dependency."

" Overt aggression may also be designed to ward off the fear of not existing."

Whether these points of view represent advances in the psycho-analytical approach or are merely modern paraphrases of earlier clinical concepts is a matter for future research. In the meantime Dr. Allchin has some pertinent observations to make on the standard procedure of healing delinquents. Is it possible, he asks, to respond to the patient's " acting out " behaviour by " acting with " his situation, supplying something he needs or affirming his identity and meaning as a human being? To the harassed probation officer, burdened by a heavy case load, all this may seem rather airy-fairy. At best he may be prepared to translate Dr. Allchin's theories into more practical behaviouristic measures; at worst he may dismiss them as mystical phantasies. Whatever his reaction, he is bound to admit that Dr. Allchin's hypotheses serve to bridge the gap between so-called pathological delinquency and " natural " crime. Whether we follow recent psycho-analytical tendencies and are ready to canonise the term " identity," or prefer more precise ego-terminology, we are bound to admit that delinquent conduct is intended to serve a purpose, and that the closer we get to the unconscious aspects of this purpose the more likely we are to behave towards the offender in an appropriate way. This is, of course, no secret to the born therapeutist who, without any special orientation in theory, understands the difficulties and needs of the offender. But not all of us have this intuitive understanding, and Dr. Allchin's essay comes therefore as a timely incentive to cultivate the offender's positive transference with appropriate tokens of counter-transference, an environmental response with which the delinquent from infancy onwards has been all too unfamiliar.

CRIME AND SOCIAL CLASS IN DENMARK

PREBEN WOLF (*Copenhagen*) *

IT is customary in Denmark to define criminals as offenders against the Criminal Code, whereby punishable violations of other acts are excluded from the definition of crime. For our purpose we prefer to define crime operationally as all offences serious enough to be officially registered by the public authorities, particularly by the police. The registry in question is the Central Police Registry for Denmark. The persons registered are all those who have been charged with an offence classified as a prosecution case (indictable offence) or with a non-indictable offence (police case) of some importance, or anybody who has received a formal admonition from the police or in court, or who is being remanded in custody, fined or otherwise sentenced, and those who have been charged but the charge against whom has been withdrawn according to the above-mentioned rules and practice of the prosecuting authorities.[1] Small violations like parking offences and riding a bicycle after dark without a light will not be found in the register and hence will not be included in this study.

Dr. Karl O. Christiansen (1959) and others have estimated the frequency of crime (indictable offences only) in Denmark on the basis of the official statistics of crime and population, and they have found about 8 per cent. criminals (thus defined) in the total Danish population of males, aged 15 years or more. In a random sample of 3,032 men and 606 women who in 1953–54 were 21 years of age or more Erik Høgh, Jan Kaarsen and the author (1958) found 569 men (18·8 per cent.) and 14 women (2·3 per cent.) registered in the Central Police Registry. The number of women is too small to warrant further investigation. The males comprise 292 (9·6 per cent.) offenders against the Criminal Codes of either 1866 or 1930 or both, and 277 (9·2 per cent.) violators of special penal laws outside the Codes.

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[1] Rigspolitichefens Kundgørelse IV nr. 91. (1941) m. senere ændringer (Proclamation of the Commissioner of Police IV no. 91 (1941) with later amendments).

The differential frequencies of male offenders in cities, towns and rural districts are shown in Table I below.

TABLE I

Distribution of Danish males, 21 years or older, according to registered crime and residence in urban or rural areas in 1953–54.

Degree of Urbanisation	Offenders against Crim. Code		Offenders against Spec. laws only		Non-offend.		Total	
Copenhagen with suburbs (the Capital)	109	13·0%	106	12·7%	621	74·3%	836	100%
Cities with 100,000 or more inhabitants	24	12·4%	20	10·3%	150	77·3%	194	100%
Towns with 20–99,000	46	13·6%	42	12·5%	249	73·9%	337	100%
Towns with 2–19,000	31	8·8%	30	8·6%	290	82·6%	351	100%
Rural districts and small towns with less than 2,000 inh.	82	6·2%	79	6·1%	1,153	87·7%	1,314	100%
Total	292	9·6%	277	9·2%	2,463	81·2%	3,032	100%

Of the 569 registered offenders 63 (11 per cent.) have never been sentenced, nor have they been subjected to any treatment or supervision imposed upon them by the prosecuting authorities but the charge has been withdrawn unconditionally, in most cases because of the nature of the evidence.

If we want to define crime in the more traditional way in order to compare our results with other studies, *e.g.*, those of K. O. Christiansen and A. Nielsen (1959), we shall have to deduct from our total number of registered offenders all violators of the special laws only and all those offenders of the Criminal Code who have had the charge against them withdrawn. Having done so, and thus defined crime in a way similar to that of Dr. Christiansen and others, we find about the same frequency as he did, namely 8 per cent. for the whole country. It is a well-known fact that the criminal frequency is greater in urban than in rural districts. It is, however, worth noting that when we move down along the scale of urbanisation we get no considerable drop in percentages before we reach towns with less than 20,000 inhabitants, and we find much the same pattern in both categories of offenders.

Frequency of Crime and the Social Class Structure

The problem of crime and social class has been a concern of reformers, politicians and social researchers through the ages. From Aristotle, Thomas More, Friedrich Engels and many others we have statements about crime and social class that might be accepted in any industrialised Western nation of today (Høgh & Wolf, 1958). Criminologists belonging to the statistical and the sociological schools of thought were studying the problems of crime and social class a hundred years ago, especially in the form of studies of occupation and crime. The Marxists among others were interested in criminality and economic conditions, poverty and crime, and frequency of crime in the proletariat compared with the criminality of the propertied classes (Bonger, 1916). Today we need not content ourselves with a rather vague three-class concept of upper, middle and lower classes or the Marxian ideas of a proletariat versus a bourgeoisie. Recent research in social stratification has provided us with much better instruments to find out about the distribution of crime over the various social strata (Wolf, 1957).

Danish criminologists who have concerned themselves with these problems have been guided by some of the stratification studies carried out by the late Theodor Geiger (1949) and by Kaare Svalastoga (1959). In his study of the Danish collaborators with the Germans during World War II Karl O. Christiansen (1955) is to some extent in agreement with Geiger's classifications. Christiansen's findings are not conclusive but they suggest a downward social mobility among the collaborators themselves compared with the social status of their parents. In another study by Karen Berntsen and Christiansen (1955) of short-term prisoners in the prisons of Copenhagen it was found that " Slightly more than one-half of the cases give distinct evidence of a social deterioration. . . ."

Erik Høgh and the present author (1958) have based their studies of crime and social class on Professor Svalastoga's research in social stratification in Denmark, and on the same sample of the population. Svalastoga's research is described in detail in his book *Prestige Class and Mobility* (1959). It is an empirical investigation based on interviewing a sample of the total Danish population, 21 years of age or more. The field study took place in 1953–54. A sample of the population rated a selection of 75 occupations according to prestige. This rating was then correlated with other status criteria such as income, wealth, education, power, etc., and the resulting nine-layer stratification scheme was applied to the total sample of 3,756 persons. The status-range is from No. 1 (Upper upper) to No. 9 (Lower lower) class, and the strata may be characterised thus:

Stratum 1. *The upper upper stratum*

The social status of this class is extremely high. No one in the total sample qualified for this class, which does not necessarily mean that it is an empty class. The members of the Danish royal family are the most conspicuous members of this highly exclusive stratum which is not likely to number more than a few hundred persons. It is a caste-like stratum, the members of which will be characterised by a long succession of high-status ancestors.

Stratum 2. *The middle upper stratum*

This stratum comprises persons whose status is on a par with that of the Prime Minister, an ambassador, a bishop and the administrative heads of ministries. Only the top leaders in any major field seem to belong here. It might be considered the summit of the possible career of a self-made man, and may number about 1,000 persons.

Stratum 3. *The lower upper stratum*

Non-employees will be found in this stratum only if they are powerful enough to control or to be responsible for 100 persons or more in their normal daily work. Employees will be admitted to stratum 3, whether their occupation involves responsibility for many persons or not, if they have a doctor's degree or the equivalent education, *e.g.*, professors and chief physicians. It may not be too much to say that stratum 3 and above qualifies for inclusion in the Danish " Who is Who." However, the converse does not hold. There are many persons in the " Who is Who " from lower strata, mostly stratum 4. Stratum 3 is estimated to number about 7,000 persons.

Stratum 4. *The upper middle stratum*

Non-employees having responsibility for between 25 and 100 persons seem to belong here. Among employees the most common qualification is an occupation, access to which will only be possible for a person with a university degree or its equivalent (below doctor's degree), *e.g.*, graduate engineer, lawyer, economist, etc. The estimated size is 2·4 per cent. of the adult population.

Stratum 5. The middle middle stratum

Non-employees may in general be considered as included in this stratum when they have social responsibility for 5 to 25 people. And employees if either they are in charge of 10 to 50 people or occupy a position demanding an education equivalent to a Danish student examination (normally 12 years of education), *e.g.*, elementary school-teacher. Size: 8 per cent. of the adult population.

Stratum 6. The lower middle stratum

Non-employees seem in general to be admitted to this stratum if they employ 1–5 people, *e.g.*, farmer or grocer with two employees. Employees seem to be admitted when they have 9–10 years of education, or failing that are in charge of from 1–10 persons.

This stratum is the largest but one, comprising 30 per cent. of the adult population.

Stratum 7. The upper lower stratum

Non-employees admitted to this stratum are those who have the family as a self-sufficient unit of production, *e.g.*, the small farmer and those who operate in an urban environment and usually own a shop. Employees in this stratum do not possess more than elementary schooling and do not supervise others, but they usually have some specialised skill, *e.g.*, skilled workers, carpenters, masons, cabinet-makers, etc.

This is the largest stratum in spite of its narrow range; it comprises 34 per cent. of the population.

Stratum 8. The middle lower stratum

This is the stratum of the typical unskilled urban worker, the agricultural labourer, and the most modest type of non-employee pursuits such as shoe-shiner or street-vendor. Altogether 24 per cent. of the adult population is estimated to belong to this stratum.

Stratum 9. The lower lower stratum

This is a stratum where the circumstances in one way or other imply a social stigma, *e.g.*, prostitutes, tramps, and more permanent recipients of public assistance, especially if the public support is supplied under conditions implying loss of freedom. People in stratum 9 are definitely under-represented in Professor Svalastoga's sample, but the size of the stratum is estimated to be about 1 per cent. of the population. In tables below, stratum 9 will be comprised with the " unknown " under the heading: Unknown and others.

The above is a simplified description of the stratification scheme of Kaare Svalastoga, who in his study has taken more factors into account.

In the existing literature on crime and social class two main points of view seem to stand out against each other:

(1) There is more crime (and more criminals) in the lower social strata than in the higher social strata.

(2) The amount of crime is the same in all classes of society, but criminal behaviour in the lower classes is more likely to result in arrest, trial and conviction.

In the present study we have not concerned ourselves with the problem of finding out which of the two points of view mentioned is more true to fact than the other. We have confined the study to the more simple task of showing the correlations between social status and the frequency of registered offenders, number of registrations per offender and severity of penalties applied.

TABLE II

Distribution of Danish males, aged 21 years or more, according to frequency of registered offenders and social status of the offenders at time of examination. 1954[2]

Social Status	Offenders against Penal Code	Offenders against Special laws	Non-offenders	N
Strata No. 1–4	2%	11%	87%	90
Stratum No. 5	4%	8%	88%	303
" " 6	5%	10%	85%	771
" " 7	11%	9%	80%	1,027
" " 8	15%	7%	78%	784
Unknown + Stratum No. 9	16%	26%	58%	57
Total	10%	9%	81%	3,032
$\chi^2=60{\cdot}1^{***}$ d.f.=4				

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[2] The following symbols will be used to denote the level of significance passed by the χ^2-test. No superscript on the value of the variable: the variable does not pass the 5 per cent. level of significance. One asterisk: the value passes the 5 per cent. level but does not pass the 1 per cent. level. Two asterisks: the value passes the 1 per cent. level but not the 0·1 per cent. level. Three asterisks: the value passes the 0·1 per cent. level of significance. Degrees of freedom are indicated thus: d.f.=.

It is seen directly from the table that 19 per cent. of adult Danish males have at least once in their lives been officially registered by the police for a punishable offence. It is also seen that there is a regular increase in the incidence of offenders against the Penal Code (ranging from 0 to 16 per cent. incidence) as we move downwards in the social strata, while there is no consistent pattern of status dependence shown among the offenders against the various penal laws outside the Code.

This tendency towards an increasing number of registered offenders with decreasing social status may be an effect of the offenders having fallen down the social ladder after having been registered because of the social stigma connected with crime and punishment. If this were the case, we should expect no or only slight upwards mobility among the delinquent sons as compared with the social status of their fathers. It was, however, found that 27·8 per cent. of the total number of offenders were upwardly mobile, 33·8 per cent. were downwardly mobile, while 38·4 stayed in the same stratum as that of their fathers. Svalastoga has reported 27·14 per cent. upwardly mobile, 30·93 per cent. downwardly mobile and 41·82 per cent. stable in his total sample, measured in the same way comparing father's status at the age of 60 with son's status at time of interviewing. It may be that the violators of the Penal Code and especially the recidivists are to a greater extent downwardly mobile, but then the offenders against the special acts must be expected to be more upwardly mobile and even more so than the law-abiding—or at least undetected—citizens of Denmark, which is not unlikely, when we take into consideration that it is here we find most of our white collar criminals.

Table III shows the correlation between social status and the number of registered offences in the sample. The test of significance does not pass the 5 per cent. level of confidence but the tendency is sufficiently clear to suggest that significance could be found if we had had a greater number of persons in the extreme categories.

In the four highest ranking strata 91 per cent. of the offenders have been registered only once and no one is registered more than twice. Furthermore it is worth noting that 83 per cent. of the offenders belonging to these strata are violators of the special laws

TABLE III

The correlation between social status and number of registered crimes per offender in a sample of Danish males, 21 years and older. 1954

Social Status	*Number of Registered Offences per Offender* 1	2	3	4	5	6 and more	N
Strata 1–4	91%	9%	0%	0%	0%	0%	12
Stratum 5	70%	14%	3%	5%	5%	3%	37
„ 6	70%	18%	7%	1%	1%	4%	120
„ 7	61%	16%	8%	3%	2%	9%	201
„ 8	57%	17%	6%	5%	4%	10%	173
„ 9 and Unknown	52%	17%	13%	9%	4%	4%	23
Total	63%	16%	7%	4%	3%	8%	566
χ^2 = 26·0 d.f. = 25							

only, and it will be seen in *Table IV* that no more than 17 per cent. have suffered more serious penalties than an official warning or a fine. Moving downwards along the social status scale we find an increasing number of offences per offender, an increasing number of violations of the Penal Code, and an increasing number of the more serious types of legal sanction, *e.g.*, imprisonment.

Table IV shows that within the strata 1–4 we find 17 per cent. sentenced to imprisonment, etc. We get 22 per cent. in stratum 5, 28 per cent. in stratum 6, 33 per cent. in stratum 7 and 42 per cent. in stratum 8. The distributions of *Table IV* vary significantly at the 5 per cent. level.

TABLE IV

The correlation between social status and severest punishment (sanction) applied against delinquents in a sample of Danish males, 21 years and older. 1954

Kind of Sanction	Social Status Str. 1–4	Str. 5	Str. 6	Str. 7	Str. 8	Str. 9 + Unknown	Total
Social care or supervision	0%	0%	0%	3%	2%	0%	1%
Admonitions, fines, etc.	58%	49%	53%	43%	35%	50%	44%
Simple detention	0%	5%	9%	10%	12%	5%	10%
Imprisonment, preventive and psychopathic detention, etc.	17%	22%	28%	33%	42%	45%	34%
Unconditional waiving of prosecution because of the nature of the evidence	25%	24%	10%	11%	9%	0%	11%
N	12	37	119	201	172	22	563
χ^2 = 28·4 d.f. = 15							

In *Table IV* we have included only the severest type of punishment suffered by those who have experienced more than one penalty. It is beyond doubt that punishments become more and more severe as you move down the scale but *Table IV* does not say anything about the reason why this is so. It may very well be a simple consequence of crimes being more serious and/or more frequent in the lower social classes. The percentages in the last row of the table are of special interest. Here we find all those who have been registered in the Central Police Registry accused of some offence, but who have never been sentenced because the charge has been withdrawn on account of the nature of the evidence. We find relatively more of these legally " not guilty " persons in the higher strata than in the lower classes. This does not necessarily mean that the prosecuting authorities discriminate against the lower classes when they decide to withdraw the charge, but rather that the crimes committed by high status individuals tend to be of a kind that is usually considered too difficult to prove in court such as the more elaborate types of fraud and embezzlement, and that these persons do not as a rule recidivate. This is, however, not our concern in this study. We just want to show by *Table IV* that among those registered for an offence, 44 per cent. have suffered negative sanctions implying deprivation of freedom, while 56 per cent. have suffered no such penalties, and that the distribution in this table, like those of *Tables II* and *III*, is biased in favour of the higher social classes.

Some Attempts at Explanation

Many social scientists have offered explanations of the fact that legally-defined crime in most western countries is characteristic of the lower social strata, especially of the unskilled workers. Sutherland (1955), Vilh. Aubert (1954) and others argue that society is more or less organised in favour of the groups in power and that the penal laws are written primarily with reference to the types of crimes committed by people of lower economic levels. Thus the penal laws are protecting the existing status system and its economic basis, and so are the acts of the judicial and penitentiary authorities. If two persons on different economic levels are equally guilty of the same offence, the one of the lower level is more likely to be arrested, convicted and committed to an institution. When we take white collar crime into consideration, we may have to agree with Reckless (1950), who is convinced that the curve for the distribution of crime among the social classes in the United States is bi-modal, with a high peak for the lower class, a low valley for the middle class, and a high peak for the upper class, or with Sutherland who believed that even the " conforming " middle classes contain a large number of criminals. Either of them may be right, especially if we accept Sutherland's (1949) view that white collar criminals, *i.e.*, people of high social status who commit legally punishable acts in the course of their occupations, are not as a rule apprehended.

In our study we have not concerned ourselves with the " dark number " theory (implied by Sutherland and Reckless), and distributions shown in *Table II* are not conclusive. Although we would find most of our white collar criminals among the offenders against the special laws, not all of them can be classified thus. The category comprises a considerable number of offenders against by-laws and traffic laws, who come from the lower strata of society. It is, of course, possible to conclude that the problem of the class differential should simply be rejected, but we rather agree with Terence Morris (1957) " —that the vast majority of crimes consists of the straightforward stealing of property and their numbers are by no means balanced by elaborately contrived frauds and deceit on the part of business men and large corporations." Terence Morris and A. K. Cohen (1956) among others also stress the marked difference in cultural norms, way of life, etc., from the higher to the lower strata. To this we might add that the pressure of temptation varies from one economic group to another, and the opportunities of crime are likewise varied according to position in society.

The answer to the question: " Why are some classes more criminal than others?" is probably found partly in the differences in culture and in style of life between higher and lower class people, partly in the fact that to some extent the Penal Code and, although to a less extent, the special laws are made to protect the interests of the leading and upper groups in society, and consequently are weighted against those groups who are less privileged. Furthermore, detection, enforcement of the laws, and administration of justice are selective forces to the prejudice of the lower classes. Finally, the social structure exerts a certain pressure upon the members of the lower classes to engage in illegal behaviour (Merton, 1957). Modern western societies emphasise such status goals as material gain and competitive success but provide limited legitimate means of achieving these goals. The class structure makes it difficult for those who have little formal education and few economic resources to get ahead in society. Stealing and other kinds of crime may be ways of achieving culturally prescribed goals of wealth and power among the members of the lower social strata. White collar crime may be a means of middle and upper class people to increase their social status through further material gains and power.

Some of the great criminologists of the last century and many sociologists of today assume that only major changes in the social structure could create radical changes in the rates of crimes committed. We believe that this is a good assumption, but we do not believe that crime will disappear completely with the introduction of a " classless society." On the contrary, we think that society cannot function without a certain inequality of social structure. The problem is to find an optimum balance between extreme equality and extreme inequality. It might be a good idea for social planners in this respect to build upon the middle class, especially the rapidly growing new middle class, which among other things is characterised by low crime rates and security in the conditions of employment, *e.g.*, monthly salary, long terms of notice, and a pension (Mills, 1956).

Conclusion

We have not, of course, by this study conclusively verified any of the above-mentioned hypotheses. We have just contributed another confirmation of the well-known fact that there is more registered crime in the cities than in the countryside and more in the lower classes than in the higher social strata. In utilising the large amount of data and detailed information of Professor Svalastoga's study of social stratification in Denmark, we have, however, been able to make our measurements with more precision than would otherwise have been possible.

In a country like Denmark, where rural districts are gradually becoming more urbanised—not just because cities grow but also because the way of life in the countryside becomes less different from the way of life in towns and cities—it must be of interest to know what size of urban community is critical with regard to crime rates. For Denmark this seems to be towns and cities with 20,000 or more inhabitants.

In studying the present penal system in Denmark we have found a bias against the lower social strata with regard to the rate of registered offenders, the number of registered offences per person, and the severity of penalties applied. This holds for rural as well as urban districts, and also more or less for violations of special penal acts outside the Code as well as for offences against the Penal Code.

Like Terence Morris in his study of Croydon, we have found that legalistically defined crime is characteristic of the working class, and especially of the unskilled workers. In his study of the frequency of crime among four groups of skilled and unskilled workers, Lauge R. Kallestrup (1954), the Danish social economist, has found that unskilled workers with stable employment had a lower crime rate than skilled workers with less secure employment. W. J. H. Sprott (1954) found in one of his studies that middle class attitudes in a working class environment were of importance in keeping down juvenile crime.

When we look at the summarised results of these studies in the light of the hypotheses mentioned above, it seems possible that, by establishing employment conditions characterised by security and stability and improved educational and training facilities for the members of the working classes, social planners should be able to provide better opportunities for people in the lower strata of society, gradually changing their activities, attitudes, and their ways of life in a direction more conforming to the norms of the higher social strata, and thereby help to reduce crime rates.

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MEN CONVICTED OF SEXUAL OFFENCES AGAINST CHILDREN

A DESCRIPTIVE FOLLOW-UP STUDY *

J. H. FITCH †

THE investigation described in this paper originated from a short, descriptive study of certain sexual offenders undertaken at Bristol prison in 1956 to satisfy local internal inquiries. Information on a number of men convicted of sexual offences against children was recorded and an attempt was made at a psychological classification. In 1960 the opportunity arose to obtain follow-up data, in the shape of subsequent criminal convictions, on these men and it was decided to enlarge the original investigation to cover these reconviction data and to test out the initial psychological classification against them.

The original group was one of 147 men convicted of sexual offences against children (*i.e.*, the age of the victim of the offence was less than sixteen) who had been received into Bristol prison either on remand or after sentence between July 1951 and October 1956 and who had been the subject of psychological examination at the prison. This was in fact the majority of cases received during this period. The follow-up period covered the interval between their release from prison and November 1960. Eight men had to be excluded from the follow-up as information showed that in November 1960 seven of them had still to be released, or had only just been released, from such sentence, while another had died during this period. The data described in this investigation are therefore restricted to 139 men. These 139 men can be sub-divided into seventy-seven men convicted of heterosexual offences and sixty-two convicted of homosexual ones. The primary aim of the investigation was to find what objective differences existed between these heterosexual and homosexual groups and then this was extended to find out what differences existed between those subsequently convicted of further sexual offences and those not so reconvicted. The results of this are discussed in the first part of this paper; the second part is devoted to the psychological classification of the offenders.

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The χ^2 (chi square) formula has been used throughout to assess the degree of association between the particular variables under study, Yates' correction being applied where the χ^2 was derived from a " two by two " table. The significance of association is shown by the value of " p "; for example, where " p " is given as " ·01," this means that the probability of this relationship occurring by chance is between 1 in a 100 and 1 in a 1,000.

The Homosexual and Heterosexual Offenders Compared

It might be argued that in cases of sexual assault on children, the sex of the victim may be a purely chance factor and a somewhat arbitrary one on which to base a comparative study of a group of such offenders. To discover if the men in this group were consistent in the sex of their victims, the complete criminal records of those with more than one conviction for a sexual offence (N=61) were studied. It was found that in only eleven cases, *i.e.*, 18 per cent., a man had convictions for both homosexual and heterosexual offences. It would appear that the choice of a heterosexual or a homosexual victim is a consistent (personality) factor in the majority of such offenders.

Age at time of offence

There was no significant difference between the two groups in respect to age:

	Homos.	Hets.	
16–30 yrs.	20	27	47
31–40 yrs.	20	31	51
41–70 yrs.	22	19	41
	62	77	139

($\chi^2 = 2{\cdot}03$, d.f. 2, $p = {\cdot}50$)

The mean age for the homosexual offenders was 36·75 years (range 17–64) and for the heterosexual offenders 35·80 (range 17–70). This suggests that these men tend to be above the average age for the prison population, a fact borne out in general for sex offenders, e.g., see Report of the Prison Commissioners, 1959, pp. 178–179.

In a national survey of all sexual offenders known to the police in one year (Radzinowicz, 1957), it was found that two in three of all such offenders were aged between twenty-one and fifty and while 34 per cent. of the heterosexual offenders were aged under twenty-one, only 9 per cent. of the homosexual offenders were. Our groups here are comprised of rather older men, as might be expected from a sample who were sentenced to imprisonment or remanded in custody because of their offences.

Type of offence

It often seems as if the name given to the offence for which the man is convicted is a legal term rather than a descriptive one. The term " indecent assault " can cover a wide range of behaviour (see also Calder, 1957) but as it is an offence that can be dealt with on summary indictment if the victim is a child, it has been considered here to pertain to the less grave offences. There appeared to be no significant difference between the two groups in respect of the type of offence for which they had been convicted, whether it was indecent assault or a more serious charge such as gross indecency, buggery, rape, carnal knowledge of a minor.

	Homos.	Hets.	
Indecent assault	40	56	96
Graver charge	22	21	43
	62	77	139

($\chi^2=0{\cdot}73$, d.f. 1, $p={\cdot}50$)

Sentence awarded

There was a significant difference between the two groups in respect of the sentences awarded. The homosexual offenders received a significantly larger number of longer penal sentences than did the heterosexual offenders.

	Homos.	Hets.	
No penal sentence	7	12	19
6 mths. imprisonment or less	9	26	35
7–24 mths. imprisonment	22	23	45
25 mths. imprisonment or more	24	16	40
	62	77	139

($\chi^2=9{\cdot}70$, d.f. 3, $p={\cdot}05$)

Previous convictions

There was a significant difference between the two groups in respect of the type of previous conviction. There were rather more heterosexual offenders (40 per cent.) than homosexual offenders (32 per cent.) without previous convictions and, of those with previous convictions, the homosexual offenders had a higher number with previous convictions for sexual offences only and fewer with previous convictions for non-sexual offences. This would suggest an essential difference between the two groups; the homosexual offenders are on the whole sexually delinquent only, while the heterosexual offenders, who have a higher rate of other offences, would seem to show a more generalised disorder of social adjustment.

	Homos.	Hets.	
No previous convictions	20	31	51
For sexual offences only	18	9	27
For sexual and other offences	12	7	19
For other offences only	12	30	42
	62	77	139

$(\chi^2=12{\cdot}93$, d.f. 3, $p={\cdot}01)$

These data on previous convictions are in keeping with the figures reported in the Cambridge study (Radzinowicz, 1957). There it was found that eight out of ten offenders had no previous convictions for sexual offences and less than two in ten had previous convictions for sexual offences.

In this latter group, there were notably more homosexual than heterosexual offenders. Of those offenders who had previous convictions for non-sexual offences only, the proportion was highest in the group of heterosexual offenders convicted of carnal knowledge offences.

Age at conviction for first sexual offence

In view of the fact that there were a small number of men who had convictions for both homosexual and heterosexual offences, for this variable it seemed more relevant to compare the nature of the first sexual offence rather than the current one to determine whether heterosexual or homosexual offences tend to be first committed at different age levels. Data already quoted from the Cambridge study suggested that this might in fact be the case but the results here suggested that with this group there was no such difference.

Age of first sex offence	Homos.	Hets.	
11–25 years	16	22	38
26–35 years	19	27	46
36–70 years	22	33	55
	57	82	139

($\chi^2=0{\cdot}04$, d.f. 2, $p=\cdot 98$)

Intelligence

On the basis of cognitive test results, a three-point classification was made of intellectual ability, " above average," " average " and " below average." There was no significant difference between the two groups of offenders but the results indicated that the homosexuals included more brighter and fewer duller men than the heterosexuals. This result is in keeping with that obtained from other investigations (see Fitch and Marriott, 1960).

	Homos.	Hets.	
Above average	11	7	18
Average	33	39	72
Below average	18	31	49
	62	77	139

($\chi^2=3{\cdot}25$, d.f. 2, $p=\cdot 20$)

Employment

These results suggested that the homosexual offenders came from a different social position than heterosexual offenders in that significantly more homosexuals had an employment record of other than labouring work.

Level of employment	Homos.	Hets.	
Skilled, clerical, professional	17	9	26
Semi-skilled	12	23	35
Labouring	33	45	78
	62	77	139

($\chi^2=6{\cdot}21$, d.f. 2, $p=\cdot 05$)

This finding is strikingly confirmed in the Cambridge study, where it was found that the proportion of manual and semi-skilled workers was highest in the heterosexual class while the proportion of persons employed in professional occupations, in offices, in personal services and in entertainment was highest in the homosexual class.

Marital status

As might be expected, a main difference between the two groups lies here, the homosexual offenders being predominantly single men.

	Homos.	Hets.	
Single	50	20	70
Married and living with wife	8	37	45
Separated, divorced, widowed	4	20	24
	62	77	139

($\chi^2 = 41{\cdot}08$, d.f. 2, $p = {\cdot}001$)

The Cambridge study also found, as it says, not surprisingly, " a very much higher proportion, in the homosexual class, of offenders who were not married at the time when they committed their offence."

Subsequent convictions

These were the offences occurring in the period between the man's release from prison and November 1960. This afforded all men in the group a period of at least twelve months since the date of release and the longest period that this interval could cover was 112 months.

The type of subsequent conviction found showed that the homosexual offenders included more men with subsequent sexual convictions and fewer men with no subsequent convictions or subsequent convictions for non-sexual offences than did the heterosexual offenders.

Subsequent convictions	Homos.	Hets.	
Sexual only	15	7	22
Sexual and other	10	3	13
Other only	7	17	24
None	30	50	80
	62	77	139

($\chi^2 = 14{\cdot}39$, d.f. 2, $p = {\cdot}01$)

If, for the two groups, the pattern of previous convictions is compared to that of subsequent convictions, it can be seen that the homosexual offenders have recidivated proportionately to their previous behaviour, *i.e.*, chiefly as sexual offenders.

	Homosexuals Convictions		
	Prev.	Subs.	
None	20	30	50
Sexual only	18	15	33
Sexual and other	12	10	22
Other only	12	7	19
	62	62	124

($\chi^2 = 3{\cdot}58$, d.f. 3, $p = {\cdot}30$)

Within the heterosexual group, those reconvicted of sexual offences have also been reconvicted proportionately to their previous behaviour, while those with a previous history of non-sexual offences only have fewer subsequent convictions for sexual or non-sexual offences.

	Heterosexuals Convictions		
	Prev.	Subs.	
None	31	50	81
Sexual only	9	7	16
Sexual and other	7	3	10
Other only	30	17	47
	77	77	154

($\chi^2=9{\cdot}68$, d.f. 3, $p={\cdot}02$)

There was absolutely no difference between the two groups in respect of the interval between release and the first subsequent conviction for a sexual offence.

Reconvicted	Homos.	Hets.	
Within 19 mths.	10	4	14
20 mths. or over	15	6	21
	25	10	35

($\chi^2=0$, d.f. 1, $p=1$)

Relationship to victim

In twenty-six cases of the heterosexual offenders and in two cases of the homosexuals, the victim was a member of the offender's own family. Within the heterosexual group, those twenty-six men who had been convicted of an incestuous offence had a higher proportion without previous sexual convictions than did the remainder (88% compared to 78%) and also contained more men married and living with their wives (84% compared to 29%) but otherwise there appeared to be little significant difference between the two subgroups. The pattern of subsequent convictions is not significantly different for the two sub-groups but the incestuous group has proportionately fewer subsequent convictions for sexual offences and more for non-sexual ones.

Subsequent Convictions	Incest	Non-Incest	
None	17	33	50
Sexual and sexual and other	2	8	10
Other only	7	10	17
	26	51	77

($\chi^2=1{\cdot}27$, d.f. 2, $p={\cdot}70$)

Summarising the results of the comparative study of the homosexual and heterosexual offenders, no significant difference was found between them in respect of age at time of offence, type of offence, age at conviction for first sexual offence, and intelligence. Major differences were found in respect of employment level and marital status, sentence awarded, and in the pattern of previous and subsequent convictions.

Those Reconvicted of Sexual Offences Compared to those Not Reconvicted of Sexual Offences

Of the 139 initially examined, the follow-up information revealed that thirty-five were subsequently reconvicted of a sexual offence. It was decided to compare the thirty-five men so reconvicted (" R Sex ") to the 104 not so reconvicted (" Not R ") to discover if there were significant differences between the two groups. It was immediately found that there were significantly more homosexual offenders in the R Sex group than heterosexuals.

	R Sex	Not R	
Homosexuals	25	37	62
Heterosexuals	10	67	77
	35	104	139

($\chi^2 = 13{\cdot}60$, d.f. 1, $p = {\cdot}001$)

Age at time of offence

There was no significant difference between the two groups on this variable.

Age	R Sex	Not R	
16–30 years	13	34	47
31–40 years	13	38	51
41–70 years	9	32	41
	35	104	139

($\chi^2 = 0{\cdot}39$, d.f. 2, $p = {\cdot}90$)

Type of offence

Significantly more homosexuals in the R Sex group had been, when first seen, convicted of an offence of indecent assault as compared to a graver charge but the difference in the heterosexual groups was not significant.

	Homosexuals		
	R Sex	Not R	
Indecent assault	21	19	40
Graver charge	4	18	22
	25	37	62

(χ^2=6·95, d.f. 1, p=·01)

	Heterosexuals		
	R Sex	Not R	
Indecent assault	8	48	56
Graver charge	2	19	21
	10	67	77

(χ^2=0·31, d.f. 1, p=·70)

Sentence awarded

This variable did not differentiate those reconvicted of a sexual offence from those not so reconvicted.

	R Sex	Not R	
No penal sentence	7	12	19
6 mths. imprisonment or less	5	30	35
7–24 mths imprisonment	14	31	45
25 mths. imprisonment or more	9	31	40
	35	104	139

(χ^2=4·35, d.f. 3, p=·30)

Previous convictions

Those reconvicted of sexual offences had significantly more previous convictions for sexual offences and about the same number of previous convictions for non-sexual offences as those not so reconvicted.

No. of previous sex convictions	R Sex	Not R	
Nil	15	79	94
One only	6	17	23
Two or more	14	8	22
	35	104	139

(χ^2=22·17, d.f. 2, p=·001)

No. of previous other convictions	R Sex	Not R	
Nil	15	63	78
One or two	11	19	30
Three or more	9	22	31
	35	104	139

(χ^2=2·79, d.f. 2, p=·30)

The Cambridge study discovered that 64% sexual recidivists had one previous conviction for a sexual offence only and only 6%

of all convicted sexual offenders had two or more previous convictions for sexual offences. The figures quoted above suggest that this group is a particularly criminally sophisticated one. The Cambridge study also showed that the proportion of offenders with previous convictions for non-sexual offences was higher in the sexual recidivist group; with our group this was a tendency only.

Age at conviction for first sexual offence

This was predominantly earlier in those reconvicted of a sexual offence.

Age at first sex conviction	R Sex	Not R	
11–25 years	12	26	38
26–35 years	15	31	46
36–70 years	8	47	55
	35	104	139

($\chi^2=5{\cdot}48$, d.f. 2, $p={\cdot}10$)

The Cambridge study showed that 60% of sexual recidivists had their first conviction for a sexual offence between the ages of 21 and 40.

Intelligence

This variable did not differentiate the two groups.

	R Sex	Not R	
Above average	4	14	18
Average	19	53	72
Below average	12	37	49
	35	104	139

($\chi^2=0{\cdot}14$, d.f. 2, $p={\cdot}95$)

This finding, that recidivism does not appear to be related to intelligence level, is in keeping with that reported by other investigators (*e.g.*, Marcus (1960), Taylor (1960)).

Employment

This variable also did not differentiate the two groups.

Level of employment	R Sex	Not R	
Skilled, etc.	8	18	26
Semi-skilled	7	28	35
Labouring	20	58	78
	35	104	139

($\chi^2=1{\cdot}01$, d.f. 2, $p={\cdot}70$)

Marital status

Significantly more single men were reconvicted of sexual offences, as would be expected in view of the fact that the "R Sex" group contained more homosexual than heterosexual offenders.

	R Sex	Not R	
Single	27	43	70
Married and with wife	4	41	45
Separated, divorced, etc.	4	20	24
	35	104	139

($\chi^2 = 13{\cdot}91$, d.f. 2, $p = {\cdot}001$)

In conclusion we can say then that, from our initial group, the sexual recidivists were predominantly homosexual offenders, single men who had been convicted of offences of indecent assault and who had a history of previous convictions for sexual offences.

An Attempt at a Psychological Classification

This investigation had arisen in the first place because of the need for more information about sexual offenders in general. This was particularly relevant to the problem of making recommendations to welfare agencies and other organisations who had the responsibility of making plans for any individual offender's rehabilitation. It was felt that some primary system of classification might be of help here.

Friedlander (1947), in commenting on the 1926 Report on Sexual Offences Against Young Persons, says: "An understanding of the variety of sexual offences may be reached by classifying them according to whether they originate in perverse sexual behaviour, are on the borderline between normal and abnormal behaviour, or are a manifestation of a developmental phase which normally is kept in repression." To base a system of diagnosis and treatment upon a classification of this kind would require the use of extensive psychoanalytic procedures and this would be rarely possible in a local prison, but this is obviously the sort of explanatory yardstick against which one needs to compare any individual offender.

It was decided to make the attempt to assess the degree of homogeneity in the personalities of this group of offenders and in the behaviour that had led up to their offence. Before describing the classification eventually arrived at, some preliminary explanation about the difficulties inherent in attempting such a task is necessary. As is generally known, sexual offenders feel themselves to be more harshly viewed and dealt with by society as a whole, and within the prison community in particular, than do other types of offender. This fear of disapproval and social ostracism seems frequently to be a projection of their own very strong guilt feelings. Understandably when called for interview by a member of the prison staff, somebody whom they are inevitably inclined at first to identify with punitive authority, they may attempt to rationalise their motives and behaviour in terms they think acceptable to whoever is interviewing them. This may especially be the case where they are on remand and, if first offenders, are bewildered and confused by the whole process they are going through. One is constantly aware of this difficulty in local prison work where there may be a steady pressure of new cases all the time and seldom very long to spend on any one of them. Of the men included in this study, full case histories and biographical details were not always available and not all of them had done personality and projective tests. The classifications had to be made on a composite of objective fact and subjective impression obtained from interview. Lacking on the whole normative data on " normal " sexual behaviour, one may tend to compare sexual offenders to an ideal or possibly idealised standard. These men were all from the same culture-pattern, although there were differences in social class. The classification made is in terms of their deviance from the generally expected and normally acceptable forms of adult sexual behaviour.

It appeared possible to distinguish five categories which, though broad and shading into one another, did seem to differentiate the men on a descriptive if not diagnostic level. These were as follows:

A. Those whose offences appeared due to their inability to identify themselves with an adult sexual role. They made essentially primitive or immature sexual overtures or responses, out of keeping with the behaviour one would expect from men of their age, which did not seem designed to bring them normal adult gratification. They appeared to be stuck, through inhibition or repression, at a childish level of psychosexual development and to be acting-out, in their offences with children, essentially infantile fantasies. The association between emotional immaturity and sexual offences is, of course, a well known one. For example, see the case histories and discussions in Friedlander (1947), Neustatter (1953) and Marcus (1960).

B. Those whose offences seemed to be a reaction against sexual or emotional frustration at an adult level. These were men who had been able to achieve adequate adjustment to adult sexuality but who had reverted to primitive modes of behaviour when made to feel insecure or rejected. This group largely consisted of those men who had turned to their children for physical as well as emotional gratification when made to feel incompetent or inadequate by their wives, and men whose offences on children were a disguised expression of the resentment and aggression they were afraid to vent on their adult sexual partners. Admittedly in any consideration of incestuous relationships it is difficult to divorce the emotional behaviour from the environmental conditions in which it took place (see also the discussion of incestuous relationships in Friedlander (1947) and East (1949)) but in the cases classified here it was felt that the emotional aspects were of as much significance as the material ones, if not more.

C. Those whose sexually aberrant acts seemed part and parcel of a generalised inability to achieve social conformity. They were men with records of instability in many fields of behaviour who felt themselves to be deprived and rejected by society and whose sexual offences, generally committed on complete strangers, were impulsive actings-out of temporary aggressive moods. It is to such offenders that the descriptive label "psychopathic" tends to get applied. As East (1949) points out, "some sexual offenders appear to belong to the constitutional psychic inferior group of psychopathic personalities and are not necessarily sexual perverts in the narrow sense."

D. Those whose sexually abnormal behaviour seemed due to pathological rather than emotional states, *i.e.*, men whose inability to control sexual impulse was a result of psychosis, mental defect, organic impairment or premature senile deterioration.

E. Those who could not be included in any of the other categories and whose offences, frequently isolated and impulsive acts, did not appear to relate to any obvious pattern of emotional or sexual difficulty.

It is not pretended that all sexual offenders could be put into such a classification, nor that these categories are the only ones possible, nor that they are mutually exclusive. They were tentative groupings designed to throw up likenesses and differences among the group under study. For brevity's sake, they can be referred to as the Immature, the Frustrated, the Sociopathic, the Pathological and the Miscellaneous groups respectively.

Initially, this study covered 147 men who were divided among these classificatory groups as follows:

A.	Immature	Total	45,	comprising	Homosexuals	33	and	Heterosexuals	12
B.	Frustrated	„	57	„	„	11		„	46
C.	Sociopathic	„	20	„	„	13		„	7
D.	Pathological	„	13	„	„	3		„	10
E.	Miscellaneous	„	12	„	„	5		„	7

But, as has been already explained, when it came to the follow-up data, eight of the total had to be excluded, reducing the groups as follows:

A.	Immature	Total	44,	comprising	Homosexuals	32	and	Heterosexuals	12
B.	Frustrated	„	56	„	„	11		„	45
C.	Sociopathic	„	19	„	„	12		„	7
D.	Pathological	„	8	„	„	2		„	6
E.	Miscellaneous	„	12	„	„	5		„	7

The following analysis of descriptive data is based on the final distribution of 139 men.

The chief difference between the groups is that A and C contain significantly more homosexual offenders than do the remainder:

	A & C	B, D, E	
Homosexuals	44	18	62
Heterosexuals	19	58	77
	63	76	139

($\chi^2=52{\cdot}29$, d.f. 1, p = ·001)

It is obvious that groups A and B contain three-quarters of the entire group and that the percentage of homosexual and heterosexual offenders in each is almost completely reversed. This, of course, could mean that such a classification as this results in nothing more than a tautological way of showing that men who commit offences on young boys are different in personality from men who commit offences against young girls. The fact that it is those judged to be immature personalities who were predominantly convicted of homosexual offences would seem to be in keeping with psychoanalytical theories of psychosexual development. Other differences between the groups, which may in some cases be related to this homosexual/heterosexual imbalance, are as follows:

Age at time of offence

Men in group A are significantly younger than the remainder, thus suggesting that their psychological immaturity is allied to chronological age.

	A	B–E	
16–30 years	22	25	47
31–40 years	13	38	51
41–70 years	9	32	41
	44	95	139

($\chi^2=8{\cdot}87$, d.f. 2, p=·02)

Type of offence

There was no significant difference in the distribution of indecent assault as compared to graver offences between the three larger groups.

	A	B	C	
Indecent assault	31	36	13	80
Graver charge	13	20	6	39
	44	56	19	119

($\chi^2=0{\cdot}44$, d.f. 2, p=·90)

Previous convictions

The distribution of these for the three larger groups was as follows:

	For sexual offences			
	A	B	C	
Some	19	15	9	43
None	25	41	10	76
	44	56	19	119

($\chi^2=4{\cdot}12$, d.f. 2, p=·20)

	For other offences			
	A	B	C	
Some	17	21	16	54
None	27	35	3	65
	44	56	19	119

($\chi^2=13{\cdot}79$, d.f. 2, p.=·001)

From the above distributions, it can be seen that group B has fewer previous convictions for sexual offences than groups A or C and this difference approaches significance when B is compared to A and C combined ($\chi^2 = 3{\cdot}27$, d.f. 1, p. = ·10). Group C has significantly more previous convictions for non-sexual offences than groups A or B.

Age at conviction for first sexual offence

	A	B–E	
11–25 years	18	20	38
26–35 years	14	32	46
36–70 years	12	43	55
	44	95	139

($\chi^2 = 6{\cdot}82$, d.f. 2, p = ·05)

Group A is significantly younger than the remainder at time of first conviction for a sexual offence.

Intelligence

	A	B	C	
Above average	7	9	1	17
Average	25	32	7	64
Below average	12	15	11	38
	44	56	19	119

($\chi^2 = 7{\cdot}26$, d.f. 4, p = ·20)

Of the three larger groups, group C contains the greater proportion of intellectually duller men. This fact rather goes against the previous finding of no relationship between intelligence and recidivism as group C consists of those men with predominantly the worst criminal records. However, as Franks (1956) has pointed out, the relationship between intelligence and recidivism remains an open question.

Marital status

As might be expected in view of the basis of the classification and the imbalance of homosexual and hetrosexual offenders within the groups, the differences in marital status between the two main groups are almost complete. Thus, group A contains 98% single men and group B 0%; group C approximates to group A with 79% single men, in this case possibly a result of the fact that group C contains predominantly antisocial personalities.

Predictions and Subsequent Convictions

It had been anticipated that, if the classification used differentiated the groups validly at a behavioural level, there would be significant inter-group differences in terms of future criminality. Thus the following predictions were made:

1. that group C, the most antisocial group, would contain the highest proportion subsequently convicted for any kind of offence and the highest proportion subsequently convicted of non-sexual offences;
2. that group B, whose sexual offences appeared to be a reaction to a particular set of circumstances or to the breakdown in a particular relationship, would have fewer men subsequently convicted of further sexual offences than group A, whose sexually aberrant behaviour appeared due to a generalised personality immaturity.

The number and kind of subsequent convictions were therefore analysed to test out these predictions but before those results are given, it is necessary to show that the men in each group had had an equivalent length of time since their release from prison and that no one group had had longer at large, and thus more opportunity to be reconvicted, than another.

Comparison of the length of time since release for those men in each group who had *not* been reconvicted of any offence during the follow-up period revealed no significant difference between the groups. This suggests that each group had had about equal opportunity, in terms of length of time available, to be reconvicted.

Time since release	A	B	C, D, E	
0–49 months	7	12	6	25
50–79 months	11	14	7	32
80–112 months	2	12	9	23
	20	38	22	80

($\chi^2 = 5{\cdot}72$, d.f. 4, $p = {\cdot}30$)

For those who had been subsequently convicted of a further offence, there was no significant difference in the time interval from release to subsequent reconviction between those whose first subsequent offence was a sexual one and those whose first subsequent offence was a non-sexual one.

Time interval between release and reconviction	Reconvicted of		
	Sexual	Other	
0–19 months	11	19	30
20–39 months	8	10	18
40–79 months	7	4	11
	26	33	59

$(\chi^2=2{\cdot}36$, d.f. 2, $p={\cdot}50)$

The number and kind of subsequent convictions occurring within the groups was as follows:

	A	B	C	D	E	
Nil	20	39	5	6	10	80
Sexual only	11	6	3	1	1	22
Sexual and other	7	1	5	0	0	13
Other only	6	10	6	1	1	24
	44	56	19	8	12	139

Analysis of these figures shows:

1. that group C has significantly more men reconvicted of any type of offence than the other two main groups;

Reconvicted or not	C	A, B	
Not reconvicted	5	59	64
Reconvicted	14	41	55
	19	100	119

$(\chi^2=5{\cdot}60$, d.f. 1, $p={\cdot}02)$

2. that group C has significantly more men reconvicted of non-sexual offences than groups A and B;

Reconvicted other offences	C	A, B	
Yes	11	24	35
No	8	76	84
	19	100	119

$(\chi^2=7{\cdot}17$, d.f. 1, $p={\cdot}01)$

3. that group B has significantly fewer men reconvicted of sexual offences than group A;

Reconvicted sexual offences	A	B	
Yes	18	7	25
No	26	49	75
	44	56	100

$(\chi^2=9{\cdot}22$, d.f. 1, $p={\cdot}01)$

4. that group B has significantly fewer men reconvicted of sexual offences than groups A and C combined;

Reconvicted sexual offences	B	A, C	
Yes	7	26	33
No	49	37	86
	56	63	119

$(\chi^2=8{\cdot}69$, d.f. 1, $p={\cdot}01)$

These results support the predictions made at a high level of confidence and indicate that behaviourally the groups are clearly differentiated.

Conclusions

This study is submitted solely as an example of the possibilities afforded to the differential treatment of offenders by a system of classification. If one recognises the validity of this or similar schemes of classification, one must admit the need for different types of training programme within prisons to deal with the rehabilitation of offenders. Such classification schemes demonstrate the psychological and social needs of the offenders concerned and can indicate the personality difficulties to which rehabilitative treatment needs to be directed.

The classification within a group of sexual offenders which has been put forward here was based on one individual's study of the men concerned and of the probable motives behind their offences. There are too many subjective elements in this particular scheme for it to be used as a scientific basis on which others could classify but it is hoped that it has been demonstrated that a classification of this kind can have validity in that it can predict future behaviour. The main object of this study has been to show that proper research along these lines would be remunerative and could result in classification schemes that might systematically be used for the treatment of offenders.

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SOME POSITIVE ASPECTS OF DELINQUENT BEHAVIOUR

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DESCRIPTIVE and organic psychiatry have made important contributions to the understanding of certain types of delinquency or criminal behaviour. But a deeper insight into the meaning and purpose both of psychiatric symptoms and of irrational behaviour has come from the work done by analysts with individual patients or with groups. It has become possible to comprehend something of the processes underlying psychological conflict, and see that these may have a positive aspect. Murray Jackson (1960), discussing Jung's prospective view of neurosis, speaks of the symptom viewed in retrospect as " the clamour of psychic contents which can no longer be ignored." Foulkes and Anthony (1957, p. 244) also indicate something positive about the symptom, saying: " The language of the symptom, although already a form of communication, is autistic. It mumbles to itself secretly, hoping to be overheard. . . ."

In fact depth psychology has been able to make sense of much mental illness occurring in the area between obvious insanity on the one hand and so-called normality on the other. And it is in this area, too, that much delinquent behaviour can be located. Now, just as we find it a rare thing for anyone to pass his life without some kind of physical illness, so we are having to accept the fact that the " normal " personality is an uncommon phenomenon, and that neurotic traits and character distortions are exceedingly common. The body, prone to disease, has developed its own protective and healing mechanisms, and it would appear that the psyche has done the same. Thus it becomes possible to see something hopeful and constructive about the apparently negative experience of psychological conflict. Murray Jackson says: " Jung's view of neurosis is that it represents an attempt by the individual at achieving a more mature level of adaptation, and although the attempt may be more or less unsuccessful, it has a highly positive significance."

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The idea that some forms of delinquent behaviour may represent an acting-out of neurotic conflicts is widely accepted, but by its very nature such acting-out tends to be anti-social or destructive and so it is not always easy to see any positive or constructive aspects. However, Winnicott (1958, p. 306), has noted the anti-social tendency as having positive significance. He writes as follows: "The anti-social tendency is characterised by an element in it which compels the environment to be important. The anti-social tendency implies hope. Lack of hope is a basic feature of the deprived child who of course is not all the time being anti-social. In the period of hope, the child manifests the anti-social tendency."

He goes on to show how this behaviour can be seen as a form of communication in so far as its purpose is to elicit a response from the environment. One attempt fails and may be followed by others, which involve different people and situations. Winnicott describes this process: " . . . the child provokes total environmental reactions as if seeking an ever-widening frame, a circle, which had as its first example the mother's arms or the mother's body. One can discern a series—the mother's body, the mother's arms, the parental relationship, the home, the family including cousins and near relations, the school, the locality with its police stations, the country with its laws." The work of Bowlby and also of Andry (1959) has given some substance to our concepts about the failure of maternal and paternal relationships, and the effect of this upon the child and his behaviour.

Those who work with delinquents discover the limitations of the psychiatric approach, be it organic, descriptive or dynamic. The analytical view provides real understanding of some mental mechanisms but seems to explain so much that at times it is doubtful whether it really explains anything at all. And this doubt is reinforced by the experience of therapeutic failure. However, analytical ideas are still developing and the emphasis of the existential analysts seems one which might be singularly fruitful in the field of delinquency. An example of such work would be the book by M. Boss on the meaning and content of the sexual perversions or the article by R. Kuhn on the attempted murder of a prostitute. This work is based on the phenomenological approach to psychiatry, which Karl Jaspers has defined as " a careful and accurate description of the subjective experience of the patient, with an effort to feel into the experience as closely as possible." Thus the patient's mode of being-in-the-world is understood and shared by another, and subjective content can be properly understood in its transference setting. The problem of feeling one's way into the world of the delinquent is especially difficult. In the first place there may be an absence of subjective symptoms or complaints. These normally form a meeting-ground between psychiatrist and patient and provide some common realm of experience, about which a dialogue of communication can develop. And then, secondly, the doctor/delinquent confrontation may reproduce all the conflict and tension which result from social, cultural and economic differences, which are a characteristic of Western societies. But a greater understanding of the delinquent's behaviour comes when it is viewed in its positive aspects as concerned with ego development and the endeavour to deal with a loss of feeling of reality and identity, and as an avoidance of an experience of weakness and dependency.

Guntrip (1960) writes about the " fear of appearing weak, inadequate or less than equal to the demands of the situation, or a failure." He says: " The feeling of weakness arises out of the lack of a reliable feeling of one's own reality and identity as an ego." Sometimes this feeling of weakness comes chiefly from internal sources and has its reference to a failure of good early relationships upon which ego development could properly proceed. But external factors may also play their part, especially in those who find themselves at the bottom of the social hierarchy, virtually deprived of security or significance as expressed in social, cultural or economic terms. Titmuss (1959, p. 2) refers to these as the " politically obscure minorities; the powerless groups; the dependent poor, the disabled, the deprived and the rejected."

The experience of loss of identity or of unreality or of depersonalisation arouses intense anxiety and this sometimes leads to motor activity, which helps to reassure the person of their actual being by exercising some ego control. At times quite small movements suffice. Stamping the foot, jumping about, pinching oneself, singing or talking have all been described by patients. But at times it seems that much more complicated behaviour may be necessary. For example, a young man of nineteen years of age, physically small and of average intelligence, seemed to be close to a schizophrenic breakdown. He had come before a court because of his exhibitionistic behaviour (indecent exposure). Now such a complex piece of behaviour occurring in relation to another person or persons of the opposite sex has many meanings. It can be seen as an attempt to establish contact, as a man, with a woman, and this by disclosing himself as a man, in the hope that the woman will disclose herself to him. But at times another mechanism seems to be at work. Under the gaze of the woman the feeling of identity weakens. The man begins to lose himself, and to view himself as if he himself were the observing woman. Such a state is often labelled " self-consciousness " but it may amount to a fall in self-awareness. In this situation the act of exposure represents a total piece of behaviour which reasserts the man's own existence and restores the boundary between himself and the other person. Further action of a more realistic kind, such as running away, can then take place, and the restored sense of " I-ness " is exercised by the remorse which follows the act and the fear of its social consequences. In a sense any assertion of one's own being against that of others has its aggressive undertones. This, too, is a recognised feature of some acts of indecent exposure and it sometimes brings an answering response of anger, which is expressed by a complaint to the police, or a beating-up.

Overt aggression may also be designed to ward off the fear of not existing. The patient quoted by R. D. Laing (1960, p. 180) describes it as follows: " Patients kick and scream and fight when they aren't sure the doctor can see them. It's a most terrifying feeling to realise that the doctor can't see the real you, that he can't understand what you feel and that he's just going ahead with his own ideas. I would start to feel that I was invisible or maybe not there at all. I had to make an uproar to see if the doctor would respond to me, and not just to his own ideas." Here is confirmation, then, of Winnicott's idea of anti-social behaviour as hopeful, and compelling the environment to be important. For the patient is still making a positive effort to communicate her feelings and assert her own being. Outside a hospital such behaviour might lead to collision with the law. Even the law's reaction may have an existence-affirming aspect. For emphasis is at once placed on the offender's identity. Whether by a policeman on the spot, or in the court itself, the initial questions are concerned with who the offender is, and his name and identity are publicly affirmed. Even to be reaffirmed in the role of existing as a bad person or a criminal may be a relief, and it is interesting to note again Laing's case. She could get some sense of her own existence and meaning by thinking of herself as a " catatonic schizophrenic," whereas her own name failed to supply this. After the court appearance may come the let-down, for committal to prison leads to the substitution of a number for the name, and in the large, uniformly ill-clad mass the sense of personal identity may be lost rather than affirmed. This is to some extent a relative matter. Those whose lives are disorganised and without any social significance (such as some chronic offenders) may still find in the rigid patterns of social life in prison some feeling of identity. For, in contrast to his chaotic life outside, a man knows what his rights and duties are as laid down in detail by the prison rules.

Another complicated act occurring in the field of delinquency is suicide and Stengel (1960, p. 285) has brought out both the complexity of its motivation and the positive, as opposed to the destructive, elements in it. He writes as follows: " The outcome of a suicidal act is either death or survival. Hitherto, only the former has been considered. A study of the latter should shed some light on the significance of suicidal acts. The suicidal attempt acts as an alarm signal and as an appeal to the environment." A further aspect of this appeal theme is also brought out by Stengel, with the idea of the suicidal act as a gamble, or a challenge to Fate. It represents a test as to whether life should or should not go on. It is interesting in this connection to think of the adolescent and young adult motorcyclists. For the need to authenticate their existence in a positive manner seems to be contained in their preoccupation with speed and their veneration of those who either avoid death or achieve it. Accident scars have a high value and preoccupation with death is expressed by nicknames (" Dave the grave ") and skulls or slogans

(" To the death ") painted on black leather jackets. These groups tend to be alienated from conventional society and its values. Feelings of insignificance may plague them to such an extent as to give the impression that society does not care whether they exist or not, or even would prefer it if they ceased to exist. This would seem to be the meaning behind the phrase used by one of the characters in *West Side Story* who says it's as if they've been told " Keep off the Earth! " or in other words cease to exist at all. In this sense, too, the experience of prison can be similarly evaluated. As far as the community is concerned the person is as dead, and his coming back to life at the end of the sentence is by no means always welcomed.

So far we have considered certain acts or more complicated patterns of behaviour in their positive aspect of restoring a feeling of identity, or warding off intense anxiety which threatens the ego. A stage beyond this can be discerned in going out into the environment to search for something needed. And this brings in the consideration of stealing which, in Winnicott's words, " is at the centre of the anti-social tendency, with the associated lying. The child who steals an object is not looking for the object stolen but seeks the mother over whom he or she has rights." Winnicott goes on to draw out the positive aspect of this behaviour, noting " . . . the capacity to perceive that the cause of the disaster lies in an environmental failure. The state of ego maturity enabling perception of this kind determines the development of an anti-social tendency instead of a psychotic illness."

However, patients with a history of deprivation and suffering from compulsive stealing may often seem very close to psychosis and, in the midst of the threatening world, one of their safety measures may include the need to control as much as possible. R. D. Laing brings out this aspect of stealing. He says: " The isolation of the self is a corollary, therefore, of the need to be in control. He prefers to steal rather than be given. He prefers to give rather than have anything, as he feels, stolen from him: *i.e.*, he has to be in control of who or what comes into him, and of who or what leaves him. . . . The individual who is sure of his own being does not require to adopt such measures " (p. 88).

This need to control can only be abated as a greater inner security develops and for this reason stealing may well persist for a long period even after a child has been placed reasonably satisfactorily with warm, affectionate adults and with ample material provisions. They for their part may be baffled as the stealing persists and may misunderstand it as a rejection of their good things, so that such children easily mobilise against themselves social attitudes which lead to further deprivation. Such individuals come into John Rich's category of " comforting offenders " and the solitary nature of the offence is often a reflection of their isolation in other respects. In contrast to the socialised offenders, these solitary offenders are likely to be highly disturbed personalities, sometimes schizoid, if not actually psychotic. T. C. N. Gibbens (1961), discussing a study of Borstal boys (ages 17–21) says: " The mentally abnormal youths had often committed the offences alone and were free from association with groups or other criminal friends. Very often, like children, they stole from home or broke into their own gas-meters and so on." R. D. Laing notes that: " Schizoid phantasies of stealing and being robbed are based on this dilemma. If you steal what you want from the other, you are in control, you are not at the mercy of what is given. But every intention is instantly felt to be reciprocated " (p. 98).

It may well be that such phantasies are behind the very marked effect which actually being robbed sometimes has on a person who himself steals. Further, the need to give to avoid being robbed might account for some of the compulsive generosity which characterises some situations. An example of this would be a merchant seaman patient who described how he worked as stoker on the voyage of a coal-burning steamer from the Far East to the United Kingdom. By dint of hard physical labour he was able to land with a good deal of money. Yet within a few hours it was all gone. This money, a translation of his physical effort, sweat and exertion was soon dissipated on the worthless hangers-on and phoney conviviality of the dockside pub. This patient has a long history of delinquent behaviour, including many larcenies and convictions of breaking and entering, and Laing's observation about these schizoid phantasies provides a basis for beginning to understand such behaviour.

These aspects of delinquent behaviour have, then, the positive aspects of being identity-affirming and seeking for contact with something outside the person. If these are hopeful signs, we are led on to the question as to how we can make a response which matches the hopeful moment and seeks to use it before it passes. If the patient is " acting-out " his inner conflicts, is it possible to respond by " acting-into " his situation by supplying something he needs or affirming his identity and meaning as a human being? I think that it is possible, although as yet too many of our ways of dealing with delinquents act in the opposite way and help to produce the chronic offender—for only a tiny number of offenders will ever receive individual psychotherapy. For most, any therapy will have to come through group situations or the structuring of a therapeutic milieu or new attitudes in society itself.

To meet the person's need for an ego-syntonic, identity-affirming experience would mean an end of mass methods, with impersonal clothing and buildings and the typical institutional régime. These in fact belong to a past controlled by different social and cultural forces and have as their only advantage that in the short term they are economically cheap. What is sought by the deprived person is a source of supply from the environment without the support of which he can never face the pain and horror which lie within the psyche of one who has experienced being unwanted and unloved. Not until they have become able to take in supplies and to trust another, to give up the need to control everything, can they become able to give out, and to give up immediate gratifications. This entails a régime which aims to relieve this basic anxiety about existence. It has nothing to do with an indifferent permissiveness or a lack of order. But it can only be based on personal respect which is communicated and mediated through every aspect of the milieu—physical, psychological and social. And it is here that perhaps we can make a contribution. Basing ourselves firmly on clinical observation, and work done with individual patients, we can point to social, political and even economic measures which, by altering society, can transform delinquency from being a social nuisance or menace into a positive stimulus towards reform and health.

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THE LAPITHOS REFORM SCHOOL

AN INTENSIVE FOLLOW-UP OF CYPRUS JUVENILE OFFENDERS

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THIS study of the Lapithos Reform School took the form of an investigation of the work of the school over the period from its foundation in 1943 until 1957 when this inquiry was completed.[1] Although the school began to receive boys in 1943, the Juvenile Offenders' Law which provided a legal setting for the school was not enacted until 1946, so that the study for all practical purposes covers a period of twelve years. Before 1946 the courts sentenced boys to the reform school in exactly the same way as they had previously sentenced them to prison for a year, six months, three months, etc. It was in the courts' discretion to decide what a boy's term of training would be. He might be sentenced to whatever period of imprisonment was allowed by law for that offence but he served his sentence at the reform school instead of prison.

A system of this kind clearly robbed the school of any formal scheme of training. The varied sentences made it impossible to plan classes, to grade according to age or to classify according to type or treatment. It was not long before the staff of the school was pressing for an improved legal pattern for the training they were prepared to give. When the Juvenile Offenders' Law appeared on the statute book in 1946 it consolidated a similar but less extensive law of 1935 and incorporated an amending law that had been passed in 1945 to provide for a uniform Reform School Order of four years with discretion given to the Director of Education to release on licence during this time. This law also introduced probation for the first time.

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[1] In all this work there was the closest co-operation between the reform school staff, the welfare officers responsible for after-care and the Cyprus Police Criminal Records Office. This study would not have been possible without their help.

It is important for our purposes to note that this Juvenile Offenders' Law of 1946 was retrospective and embraced any boys committed in 1945. To obtain a picture of the school and its work and to avoid the complications of these first years we have therefore ignored the 1943–44 sentences and confined attention to the years 1945–57 inclusive.

During the twelve years 1945–57 a total of 367 boys were committed to the reform school on four-year orders. Over a third of the boys came to the school from the Nicosia District, which includes the island's capital town. Limassol's committals amounted to just over a half those of Nicosia. Of the other districts, it is interesting to see that a thinly populated area like Paphos sent more boys to the school than either Larnaca or Famagusta. Clearly much depended on the attitudes of local magistrates and probation officers. The peak year for committals was 1947—soon after the enactment of the new law.

The 260 in our sample consisted of 188 Greeks, seventy Turks and two English boys whose parents were working for a local mining firm. These two were released when the family returned to England. With 26·92 per cent. of the total committals the Turkish community is more than proportionately represented, since Turks in Cyprus are only 20 per cent. of the population. This rather more than proportionate share of delinquents is also shown in the Turkish figures for probation.[2]

Analysing the groups by ages we have:

Over 15 and under 16	84	32·3%
Over 14 and under 15	78	30%
Over 13 and under 14	35	
Over 12 and under 13	32	
Over 11 and under 12	12	
Over 10 and under 11	9	
Over 9 and under 10	8	
Over 8 and under 9	1	
Under 8 years	1	
	260	

This close analysis year by year was done in order to compare the results with those of a survey of juvenile delinquency in Cyprus in 1952 carried out by the present writer (1954a and b). There was in fact a very close similarity. Thus we see that 62·3 per cent. of committals to the reform school were aged between fourteen and sixteen. The 1952 survey showed that 66·2 per cent. of all juveniles appearing before the courts of the island in that year were aged between fourteen and sixteen. The figures for other years did not differ significantly. As we might expect, our committals are concentrated in the teen-ages. A Reform School Order cannot be made after the age of sixteen and 75·76 per cent. of the orders were for boys between thirteen and sixteen. One boy committed was under the age of criminal responsibility. He was a boy who had been accepted for care by an orphanage and had set fire to certain articles there. He was said to be beyond the control of the staff and in need of care and protection. As there were no children's homes (except this orphanage) in Cyprus at this time and the reform school was legally designated an institution to which children in need of care and protection could be committed, the boy had accordingly been sent there. This was the only case of its kind in our sample of 260.

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[2] See Annual Reports on Social Welfare 1953, 1954, 1955, and Annual Reports on Social Development 1956 and 1957 (Government Printer, Cyprus).

When we looked at the criminal records of our committals we were surprised to find that no less than 144 or 54·96 per cent. of the total had *not* been before a court previously. Another 30 per cent. had but one previous conviction before being sent to the school and only 14·61 per cent. of the total had two or more previous convictions. This last percentage, however, included three boys with no less than six previous offences before being sent to the school, one boy with five offences and four with four previous findings of guilt. One rather tends to think of a reform school as receiving offenders who have already been before the courts and have been given another chance—either by probation, fine or conditional discharge. As shown, this certainly was not the case at Lapithos during the period we are considering and this was no doubt partly because probation did not operate in the island until 1946. There is also the possibility that the boys eventually sent to the school, although they had not been before a court previously, had in fact long records of previous *social* misbehaviour.

Turning now to the types of offences for which the boys went to the reform school we divided them into four broad categories—offences against the person, sexual offences, predatory offences and miscellaneous. It is in keeping with other studies of crime in Cyprus (Clifford, 1954a and b) and elsewhere that predatory offences should predominate and 66·53 per cent. of all the 260 boys committed were committed for predatory offences. Sexual offenders constituted 8·84 per cent. of the total and were slightly more numerous than those sent to the school for other types of offences against the person. Forty-four boys were committed for miscellaneous offences which included breaches of probation, further offences whilst on probation, persistent begging, serious traffic offences, carrying a knife, etc. Sometimes the offence was not grave but seemed to represent the end of a consequential chain of disruptive behaviour leading to the reform school.

A Reform School Order is for four years, providing the offender has not reached the age of fifteen. If he has, then the Order can only extend up to his nineteenth birthday. Only the Governor could authorise licensing within the first year of an Order being made but thereafter discretion, as already explained, is given to the Director of Education. It is interesting now to see how long the boys did in fact spend at school and on licence. Of our 260, eighty-two or 31·5 per cent. spent from two to two-and-a-half years at the school and over 75 per cent. were at the school between eighteen months and three years. Eight only were held for less than one year and a few had been kept over three years, but these were clearly exceptional; the usual form was for a boy to be considered for release on licence any time after the first eighteen months and he would generally be out on licence within two-and-a-half years.

This means, of course, that the average period on licence was from two-and-a-half years down to eighteen months and the actual figures confirm this. There were, however, twenty whose Orders expired without the boys being released on licence. Of these, four were committed to the reform school and two were sent to prison for offences. Another nine were sent to prison for being unruly at the reform school.

With this broad view of the 260 boys we are dealing with, their previous records, types of offences, ages, community and the way in which they served the periods of their Orders, we can now examine the results achieved with these offenders who passed through the school.

Results According to Reconvictions

For this part of the inquiry the help of the Cyprus Police Criminal Records Office was sought and freely given. The aim was to examine each boy's conduct: (a) whilst at the school; (b) whilst on licence; (c) after the order expired to December 31, 1957.

(a) *Whilst at the School.* Only twenty boys were brought before a court for offences committed whilst at the school. And in fact most of these offences, other than the eleven brought by the headmaster against boys too unruly for the school to deal with, were offences committed whilst the boys were actually on leave (*e.g.*, at Christmas or Easter). In one case the boy was at the school for only one day before absconding and committing a further offence for which he was sent to prison. But over 90 per cent. of the 260 committed no offence whilst at the school.

(b) *Whilst on licence.* Convictions go up when we look at the licensing period. They more than double and forty-two boys were convicted during the time they were on licence. This still means, however, that the success rate for the licence period is remarkably high at 83·85 per cent. In fact, if we exclude minor offences, the success rate rises to 86·92 per cent.—a much higher percentage than that obtained for probation in Cyprus over the past ten years.

If now we consider together the two periods above and examine the conduct of the boys from the time of committal to the end of the licence, we find that in this total period sixty committed offences and our success rate falls to 76·92 per cent. (or 80 per cent. if minor offences be disregarded). This is still a figure for a four-year period which compares favourably with reform or approved school results in other parts of the world.

(c) *After expiration of order to December* 31, 1957. It is important to remember here that the extent of this follow-up period varied with the date at which the order commenced. Thus, for those boys committed in 1945 we have an eight-year follow-up; for 1946 orders it becomes a seven-year follow-up; and so on until the orders made in 1953 and 1954 have no follow-up to speak of. With this qualification in mind it can now be noted that of the total 260 cases, 137 were convicted during the follow-up. This means that the success rate during follow-up was 47·3 per cent. only. But with the varying periods of scrutiny this did not tell us all we wanted to know. True, over the whole range, including some periods of six to eight years follow-up, nearly half of the boys had kept out of further trouble, and if we discounted such minor offences as traffic, breach of the peace, etc., this success rate rose to 60·76 per cent. To get closer to the significance of after-conduct we divided our results according to the period of follow-up being taken into account. This gave us the following:

Period of Follow-up	*Percentage Unconvicted*
Up to one year	75·86
One to three years	73·01
Three to five years	53·84
Over five years	60·76

N.B. Minor offences excluded (e.g., traffic offences, wireless licences, etc.).

The 60 per cent. success with boys followed up for a period of five years or more after the expiration of a four-year order is particularly indicative of the good results following reform school training in Cyprus.

It has been suggested by the Mannheim/Wilkins (1955) study of prediction methods in relation to Borstal boys that the first year after release is the most important for success or failure. In this study, therefore, we checked the length of time from release to the commission of the first offence. In the period after leaving the school only 36·36 per cent. were convicted in the first eighteen months (23·63 per cent. in the first year); but 54·54 per cent. were convicted within the first two years. When we take the first year after the expiration of the order (*i.e.*, after licence) over 53 per cent. were convicted within the first twelve months. This seems to confirm the importance of the first year after an order. If we considered the first eighteen months, then over 72 per cent. of those convicted during the follow-up period were before the courts during this year and a half. Finally, we examined, in particular, the forty-seven cases that had been followed for more than five years after the expiration of the order. Of these nearly 32 per cent. were convicted during the first year after release from the school and 27·66 per cent. were convicted in the first year after the expiration of the order. This seems to suggest that the first year after leaving the school is rather more important than the first year after the expiration of licence supervision but the difference is not great. No less than thirteen of the fifteen convicted within one year of release from the school proved to be recidivists in the years that followed, *i.e.*, committed four or more offences. This happened with only eight out of the thirteen convicted in the first year after licence had expired.

Before leaving this section of the study we tried to find whether community, age, previous convictions or previous probation had had any significant effect on the results. This investigation proved to be largely negative, however, there being no really significant correlations between these factors and the general results.

Results According to Social Adjustment

It was necessary to see whether the results we had obtained by scrutinising reconvictions (or the lack of them) were a fair measure of the value of the reform school. It has always been felt that appearances at court, though objective as a criterion, may not give a clear account of the reformative value of particular treatment. A lapse during the process of improvement, for instance, leads to an unsatisfactory classification and may give a false picture of the extent to which reformation has been achieved. Equally, an ability to keep out of trouble may reflect greater skill in evading the forces of law and order rather than any positive improvement in social adaptation.

The attempt to measure social adjustment rather than reconvictions as a truer guide to the value of reformative treatment was a feature of the Rumney/Murphy (1952) follow-up of ex-probationers published a few years ago. In Cyprus it was done by the writer (1958) in a study of probation which included a follow-up of all 1952 probationers and the Cyprus study showed a greater correspondence than had the American investigation between the results according to reconvictions and the results according to social adjustment. There were differences between the two studies which might well account for this and which need not detain us here, but it should be remembered that with a small island and an integrated population the possibility of error in assessing social rehabilitation is considerably reduced.

We had to devise some means of checking on social adjustment as compared with reconvictions. Fortunately this was not at all difficult if one was prepared to allow for a rather larger share of subjectivism in the evaluation. The headmaster of the reform school had been there since it was founded and was personally acquainted with nearly all the 260 boys who had passed through his care. He had also followed their progress by means of the after-care system for years after they had left the school and he had kept in touch with the progress of most of them up to the present. This is not so difficult in Cyprus as it may sound. In such a compact territory it is impossible to avoid an informal follow-up of all the boys who had passed through the school. Their work successes and failures, subsequent marriage and children, their rise to respectability or descent to unsavoury reputation—all become known to those personally acquainted with the boys especially if, like the headmaster, they are constantly travelling in the different districts of the island. It is not very difficult for a trained social worker to estimate social adjustment in Cyprus, and in this case there was always the possible check with the particular after-care officer.

To assess therefore the social adjustment of the boys who had left the reform school, the 260 names were placed before the headmaster of the school. He was asked to say whether or not, from his own knowledge, each boy had settled down in society and was making satisfactory progress. He was not shown the records of reconvictions that had been checked with the Criminal Records Office, but it would be misleading to suggest that he was not aware of the reconvictions in most of the important cases. These had naturally come to his notice. Nevertheless he was asked to give a definite opinion as to whether there had been a distinct and satisfactory readjustment by the boy despite reconvictions—indeed, without any reference to reconvictions at all. The results of this subjective assessment by the headmaster are shown here against the results according to reconvictions.

According to reappearance at court			According to headmaster's assessment of rehabilitation			
Total	Reconvicted up to 31.12.57	Unconvicted up to 31.12.57	Total	Unsatisfactory	Satisfactory	Doubt
260	119	141	260	61	166	28
Success rate: 54·2%			Unknown to headmaster: 5 Satisfaction rate: 64·84%			

It will be seen that about 10 per cent. more were considered satisfactory by the headmaster than could have been satisfactory according to the success rate by reconvictions. As a matter of fact, this was very close to the result obtained in the follow-up of ex-probationers (Clifford, 1958). There, too, the difference was about 10 per cent. and it was the subjective assessment that tended to be generous.

It seems, therefore, that with ex-reform school boys as with probationers, and according to subjective assessment carried out by different persons experienced in social work, the fairness of reconvictions as a measure of social adjustment is confirmed. We see little difference between the results of a reformative treatment as shown by reappearances at court and the results as shown by an experienced social worker's assessment of resettlement.

Case Study

Having now examined the results of the reform school training from the point of view of reconvictions and with reference to the present-day circumstances of the ex-reform school boys, the next step was to attempt to relate the results as far as possible to the actual work that had been done by the school, as distinct from other environmental influences.

A survey of all the personal files at the reform school showed that the casework recording was very uneven. Sometimes there was a full account of the boy's progress from the pre-trial report to the end of the licence period. Unfortunately the information was often less complete and on some files only the bare details of the court appearance, committal to the school and the headmaster's report on release were to be found. The number of entries in a case record varied considerably.

The first requisite for any consideration of the school training was a sample of fairly complete records. After a careful study of all the available personal papers, forty-two case-files were abstracted as being more or less complete. These formed the material for our case-study. It was necessary to obtain whatever information we might require regarding the work at the school and the progress afterwards from these forty-two case-files since no others were sufficiently documented for our purpose. Each of our forty-two files, however, contained the pre-trial report of the probation officer, the committal order to the school, full entries on the boy's progress whilst he was at the school, the headmaster's report on the boy's release from the school and, of course, the various progress reports sent to the headmaster by the welfare officer supervising the boy on licence.

Unfortunately no file provided us with a detailed diagnosis of the case on reception or with any outlined plan of treatment whilst at the school. Of course, there is such a diagnosis in every case and treatment is, in fact, planned—but it is done by the headmaster informally and, as our forty-two records show, it was not systematically recorded in the case-files.

The problems arising from a single reform school serving the whole island for both Greeks and Turks, for all ages and for all different kinds of offences and offenders, will be evident from what has gone before. Every boy is a separate problem, his placing within the school a balance of advantages and disadvantages. Usually a boy has to be allocated to a place in the school that is not considered entirely suitable but is still the least objectionable of several possible combinations.

The first objective in our case study was to try to identify the factors which had led a court to select a boy for reform school treatment. With this in view the forty-two cases were closely studied for the factors which seemed to recur in the pre-trial reports. To ensure a frequency that would be significant every record was checked, every factor in the pre-trial report listed and its frequency noted in every one of the other records. Then with the list complete all factors that had appeared in the forty-two files less than thirteen times were discarded. This procedure left us with the following items as the most significant features in the pre-trial reports of boys sent to the reform school:

Bad home relationship	38
Previous record of delinquency	35
Defective discipline	28
Instability in work (or workshy)	24
Bad associations and participation in gangs	23
Beyond parental control	22
Mother of immoral reputation	17
Last or only child	17
Poor financial circumstances	16
In need of care or protection	14
Overcrowded home conditions	13

Amongst the items discarded were factors like: father a drunkard or gambler, father deserted, sexual perversions, nuisance to local community, neglected, illegitimate, parent dead, etc. But these, as mentioned above, did not appear in our reports with a frequency likely to prove significant.

It is interesting to compare this search for and abstraction of factors leading to selection for reform school treatment with a similar but independent study of the factors in pre-trial reports which seemed to lead to selection for probation in Cyprus (Clifford, 1958, unpublished sections). A study of the pre-trial reports for eighty-nine cases appearing before the Nicosia courts in 1952 and placed on probation produced the following list:

Inadequate parental care or control	67
Probation recommended	54
Bad local reputation	37
No previous convictions	37
Seriousness of offence	34
Weak character or immaturity	16
Backwardness	11
Instability at work	10
Youth	10

The writer and the same panel of social workers made the search in both studies but deliberately avoided referring to the first study whilst engaged on the second. They tried to be guided by what they saw in the pre-trial reports rather than what they might have expected to be there. They also tried to avoid reading the mind of the officer who had done the pre-trial report and they kept strictly to his wording. This accounts for the considerable divergence in the naming of the factors; clearly the same kind of thing is being described in different ways in the two studies. "Inadequate parental care or control," for example, occurred most frequently in the probation study: in the reform school reports this same set of circumstances in the home is implied by the four headings "Bad home relationships," "Defective discipline,". "Beyond parental control," "In need of care and protection." Not all of these are the same thing, of course, but they are factors produced by similar conditions. Again "Bad local reputation," which features prominently in the probation selection, appears well up on the reform school list as "Previous record of delinquency" and may be covered by "Bad associations and participation in gangs." In this study "Previous record of delinquency" had to extend beyond the list of recorded convictions for, as shown, many of the boys committed to the school were ostensibly first offenders but a check of their earlier conduct revealed a number of quite definite crimes they were known to have committed but for which they had never been prosecuted. It is worthy of note that previous delinquency is strongly marked in selection for reform school (even though not legally recorded delinquency), whilst in the probation study the local reputation and " No previous convictions " vied as reasons for an award of probation. Obviously one reason for a reform school order rather than probation was the extent of previous delinquency. (Incidentally the number of the forty-two cases examined who had been awarded probation previously was too small to be taken into account.) Another factor that is more prominent in selection for reform school than in the selection for probation is the boy's instability at work. It is fourth in the list of factors in the reform school sample and appeared only eighth in the probation sample.

The offence and its seriousness seemed to be a more effective factor in selection for probation than in selection for the reform school. This is not easy to explain but, if it means that for institutional treatment the courts pay more attention to home circumstances, then it is all to the good.

Weak character or immaturity is not mentioned as a factor for reform school training though it has a place in the selection for probation. This may be accounted for by the fact that the other factors in the circumstances of boys suitable for reform school training tend to overshadow the significance of this particular one. It may be that most boys needing institutional treatment have shown more positive criminal inclinations than vacillation or a willingness to be led. Our data suggested no answer to this.

So much for a comparison with the factors that seemed to have led to selection for probation. Methodologically our comparison is open to serious criticism. One group was twice the size of the other, the categories were vague and imprecise. All this is true. What we were trying to do, however, was to show what information was actually provided by the case-records. It is presented here with all its defects and with interpretation which can clearly be nothing more than suggestive. Had the comparison been planned ahead it would perhaps have been possible to avoid such inadequacies. Both lists, however, reflect well-known delinquent syndromes. They differ in some respects, but at this stage we can hardly say whether or not such differences are objective, or result from the different sizes of the samples. They may reflect the differences of approach of the officers completing the pre-trial reports or finally, and perhaps more seriously, it may be that for all their efforts the social workers forming the panel that worked on the cases for this study were not entirely consistent in the selection of factors. Certainly an attempt was made to eliminate this last possibility, but it would be unrealistic to think that subjectivism could be avoided altogether.

Now for the period at the school, we have already seen that the forty-two cases did not tell us very much about the diagnosis, pattern of treatment or the stage by stage progress of the boys. Clearly the quality of the training and treatment provided by the school will have varied according to the gifts and failings of individual housemasters, but the school is small enough for each of the boys to have been under the personal eye of the headmaster who directed the treatment in each case. To this extent each boy passing through the school represented a success or failure for the treatment prescribed by the headmaster and there was a general uniformity of supervision and guidance.

To test how effective the work at the school had been we had recourse to a technique for measuring " movement " in the case whilst at the school—a technique first suggested by Hunt and Kogan (1950) but applied in a rather different form by the present writer to a study of probation cases in 1958. In that study a chart of sixteen items that seemed amenable to assessment before, during and after probation treatment were compiled after a team of experienced caseworkers had gone through all the records. In the first study approximately fifty possible factors that could be measured were abstracted from the files and then re-examined for possible overlapping, extent of distribution throughout the sample and suitability for calculation. In all this the panel of social caseworkers checked each other's assessments to find a hard core on which they seemed to agree and it was experience of casework rather than statistical method that decided the factors likely to be both significant and measurable. Eventually sixteen items were selected as follows:

1. Frequency of domestic change, *i.e.*, any movement of the family (or offender if living away from family).
2. Relationship with parents.
3. Relationship between parents.
4. Relationship between parents and others at home (*i.e.*, grandparents, etc. This is important in extended family life of Cyprus.)
5. Influence of parents on the offender.
6. Influence of siblings, relations or associates on offender.
7. Personal reputation } These are important in the group
8. Family reputation } influence of Cyprus life.
9. Personal health.
10. Family health
11. Housing conditions: (a) comfort; (b) overcrowding.
12. Influence of locality.
13. Financial circumstances.
14. Ability to handle money wisely.
15. Social relationships.
16. Work habits.

These factors were, of course, worked out with specific reference to probation and our only justification for using them in an attempt to measure movement in the reform school cases was that, in addition to the boy's treatment at the school, the after-care officers work with the homes and during periods when the boy is on leave the supervision resembles that of probation. Furthermore, the licensing period is very like probation. The chart evolved in the earlier study was therefore used and these sixteen factors were marked on a scale ranging from +2 to −2 according to improvement or deterioration in each of these sixteen " areas of change." On this scale the position in each " area of change " was marked by the same panel of caseworkers without reference to reconvictions or to the headmaster's personal assessment of social adjustment. It was marked three times: once according to the pre-trial report; secondly, according to the position on release from the school; and, lastly, according to the position at the end of the licence. Finally, an independent social worker was asked to work out the differences between the columns. This last worker, who knew nothing of the actual cases, was given the charts without names and had nothing to do but calculate mathematically the differences shown. If the difference was anywhere between + 5 and − 5 he was asked to mark it as doubtful. Above + 5 the case was classified as satisfactory and below − 5 was to be considered unsatisfactory.

It should be explained that these three categories indicated whether the " change " noted *during the period of the order* was satisfactory, *i.e.*, an improvement, or unsatisfactory, *i.e.*, a deterioration. Once these results had been obtained they were compared with the results already obtained independently for reconvictions and social adjustment. The contrast was as follows:

Assessments	*Satisfactory*	*Doubtful*	*Unsatisfactory*	*Total*
According to reconvictions	28 (66·66%)	—	14	42
According to personal assessment	33 (78·57%)	3	6	42
According to measurement chart assessment	29 (69·04%)	10	3	42

It will be seen that the correspondence in satisfactory cases is considerable, but a much larger number are unsatisfactory according to criminal records than according to the other criteria. This difference may be accounted for by the large number which the measurement chart leaves as doubtful. It will be seen therefore that, at least as far as improvements were concerned, it was possible to show a positive relationship with the results obtained independently by reconvictions and personal assessment. To go further and say that the treatment during the course of the Reform School Order was the cause of the results would be to overstep our data, but the strong presumption that this improvement was a consequence of treatment can hardly be ignored. We did not compare the school period with the licence period for extent of improvement because the chart, having been devised for non-institutional treatment, could have been very misleading when applied to the institutional period alone.

One of the fundamental difficulties in trying to measure change during a period of casework supervision or treatment is that we would have to know the change occurring in the population generally to be able to arrive at the true meaning of the improvements or deteriorations we record. The limitations of this attempt are therefore fully appreciated but the measured improvements being so closely related to reconvictions and to personal assessment suggests that casework approaches of this kind are not without their value.

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CURRENT SURVEY

RESEARCH AND METHODOLOGY

PSYCHOANALYSIS AND "CONTROLLED" RESEARCH ON DELINQUENCY

EDWARD GLOVER

As the scientific literature on criminology expands one encounters every now and then surveys describing "advances" in methods of research dealing with the causes of crime and with its diagnosis, treatment and prevention. These are of course entirely laudable attempts to correlate the "positive" findings arrived at by the different branches of science concerned with crime. But although developments in multi-disciplined research are generally and rightly regarded as signs of scientific progress, an increasing amount of dissatisfaction is expressed regarding the results obtained. This applies in particular to studies of causation. Factors previously regarded as of outstanding significance are sometimes found to be non-specific. To take the case of psychiatric research alone: as studies extend beyond the frontiers of "pathological" crime, to include the behaviour problems of "predelinquent" and indeed of "normal" children and adolescents it becomes increasingly difficult to isolate factors that are specific for the adult offender. Studies of environmental factors are especially disappointing in this respect.

This is a state of affairs which deserves more than passing attention. No doubt a good deal of heart-searching could be avoided if those who embark on surveys of the literature, having recorded all reliable "advances," would proceed to correlate "negative" findings. For consistent negative findings, if adequately correlated, may end by becoming pointers to more fruitful fields or keypoints of research. At the very least a reliable consensus of negative findings would avoid a good deal of unnecessary overlapping of research projects. No doubt with the development of new methods of research it would be necessary to recheck this consensus: but to begin with a "negative survey" would spare workers a considerable amount of fruitless effort.[1]

Useful as the discovery of blind-alleys undoubtedly is, it would not resolve our problem. The main object of this communication is to draw attention to the retardation of effective research that follows from the absence of comparative surveys of *methodology*, in other words, of the first principles followed by different branches of criminology. As paradigmatic of the problem I have chosen the validity of the methods of " controlling " findings by the examination of " matched control groups."

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[1] Prominent amongst workers who have respect for the "negative finding" are Mannheim and Wilkins (1955), Carr-Saunders, Mannheim and Rhodes (1942), Sir Cyril Burt (1925) and the Gluecks (1950, *et passim*).

Now it can be freely conceded that the " controlled experiment " or " survey " is one of the most valued of scientific procedures; so much so that clinical formulations unchecked by control groups are generally regarded as subject to gross subjective error. Psychoanalytic findings, for example, are frequently criticised because psychoanalysts rarely subject them to statistical controls. The thesis I wish to present here is that, *owing to the existence of unconscious mental structures and functions, the so-called " controlled " experiment in mental science is subject also to gross error.*

As has been emphasised, this thesis itself does not constitute a criticism of the desirability of conducting controlled experiments or surveys. It can be further agreed that if psychoanalytical units of comparison could be expressed in terms that are capable of statistical control (a state of affairs which is by no means so common as might be supposed), they should be so controlled. What it does maintain is that, *in mental affairs, the recording of controlled findings does not represent the final stage of the investigation in question. The final estimation of mental factors depends not just on statistical investigation of tables but on the interpretation of the statistical results.* And this in spite of the fact that the interpretative process is itself liable to gross subjective error.

At this point the observer trained in the methods of natural science may feel that there is no safe limit to psychoanalytical perversity and prejudice. " If," he may well ask, " a method of interpretation is, at a reasonable estimate, subject to 50 per cent. error, how are we ever to secure the ultimate validity of any proposition based on it? " To which the psychoanalyst might well reply that, when faced with ignorance or uncertainty, a fifty-fifty system is much better than nothing. But the argument need not be conducted along such polemical lines. The psychoanalyst is quite ready to admit errors both of omission and of commission in the practice of interpretation. He maintains, however, that the observations and introspections which constitute the ground-work of the usual controlled investigation of delinquencies are merely *end results* which seldom give any direct indication of the mental processes leading to them, and that unless these processes are uncovered with reasonable accuracy (and in most instances this involves interpretation) we have no means of making etiological distinctions between one case and another; unless of course it is possible to establish the existence of characteristic *syndromes*, or associated symptoms.

It is difficult to extend this argument without appearing to beg the question of scientific control. On the other hand, clinical observers may be allowed the privilege of formulating their own clinical inferences and conclusions. Thus, to take the case of simple theft, the clinician studying his pathological observations maintains that theft may be associated with a great variety of clinical symptoms, with hysteria for example or obsessional states, with a variety of psychotic conditions, with alcoholism, epilepsy, psychopathy and a great variety of characterological disorders. *Per contra* precisely similar forms of theft may be observed where no gross psychopathological symptoms or character traits can be detected. These observations the psychoanalyst takes in his stride. Experience of clinical medicine warns him that a raised temperature may have a great variety of causes, including the normal intake of food or the effects of violent exercise, and he has no reason to suppose that causal variation does not apply also to the phenomena of pilfering.

Similarly in the case of crimes more serious than that of theft. If shortly after making a homicidal attack an offender begins to show signs of schizophrenia the clinical psychiatrist feels justified in distinguishing the offence from an identical attack carried out by an individual who presents no abnormal features apart from stress of circumstances. In short, comparative study of pathological offenders indicates that observations based on the identity or similarity of the offence call for *control on an etiological basis* which, however, cannot well be achieved without accurate investigation of developmental factors for which there may be little or no direct evidence. And this involves the use of interpretation.

So much for the problems encountered when studying immediate criminological data. The situation becomes more complicated, however, when one studies the simplest attempts made in the course of history-taking to establish elementary controls before arriving at conclusions about causation. The best example is that of the "family history" of a delinquent case. To be sure, the taking of a "family history" serves a multiplicity of aims. It represents a rough-and-ready attempt to estimate constitutional factors, as a rule of a psychological nature. It is also an attempt to measure environmental influences, *e.g.*, the amount of traumatic excitation to which any one offender has been subject, and in the last resort it enables the observer to speculate regarding endopsychic factors in the situation. These endopsychic factors, however, cannot necessarily be demonstrated directly: they depend on a psychological assessment (interpretation) of mostly unconscious factors, *e.g.*, the influence of unconscious identification, or of projection.

Over and above this the family history raises a problem in "control." For the obvious conclusion with which the investigator is commonly confronted is that in spite of the apparent similarity of familial conditions many of the siblings in the delinquent's family are non-delinquent. Not that the psychiatric observer is at all surprised by this observation. In his view it would be ridiculous to assume that, with the exception of some identical twins, different members of any one family are of the same temperament or respond in the same way to familial influences.[2] Nevertheless, this investigation of family influences constitutes one of the most immediate efforts to control etiological research. And we must face the fact that the difference between a law-abiding and a delinquent member of one and the same family calls, more often than not, for an explanation other than that of environmental influence.

Incidentally this problem is not unfamiliar to the psychiatrist. When confronted, for example, by a simple case of psycho-neurosis, he is frequently at a loss to explain why other members of the same family do not appear to have responded to allegedly similar familial influences with similar pathological manifestations.[3] A " normal " individual may inquire why it was that his brother developed schizophrenia and why by comparison he has been able to regard his own reality reactions throughout life as unimpaired.

Here we may pause to evaluate such familial factors as the " broken home," the " affection deprived child," the influence of " separation anxiety " and similar causal explanations which when first adumbrated seemed to promise some solution of the etiology of delinquency. Studying the reactions of different members of the same family to comparable conditions, it would seem that we have good reason to distrust such environmental explanations. Indeed we can go so far as to say that *the familial control is not in any scientific sense a control : it is on the contrary a problem in psychodynamics.*

But if, comparing the reactions of members of the same family, we find it difficult to " control " our speculations regarding causation, what are we to think of those standard investigations in which a system of extrafamilial " matched controls " is adopted? In other words, if the familial controls are undependable how much less dependable are extrafamilial controls based on assumptions which though apparently scientific in intent cannot always be substantiated? Comparing delinquent and non-delinquent groups, it is the custom to select controls which for age, social circumstances, etc., are not too glaringly different. But why should we assume that a parity of ages has any standard psychological significance? The established facts of development should warn us that development is not entirely subject to the calendar. And why should we assume that similar circumstances will produce similar reactions in subjects who, in the constitutional and developmental senses, are infinitely variable?

Having indicated possible flaws in some of the processes of controlling observations we may now turn to the essential issue, namely, *how far in our investigations are we led astray by the cultivation of statistical standards and*

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[2] Even if we were to assume what is in the highest degree improbable, viz., that precisely the same reactions are developed by the parents towards different members of the same family.

[3] Not that this outcome is unfamiliar. A case of agoraphobia may report that his sister suffers from precisely similar symptoms. And it is well known that a neurosis in the parents can be " copied " by one or more members of the family

controls based mainly on behaviouristic data: in other words, how far is the unsatisfactoriness of a good deal of work on delinquency a measure of our lack of psychological imagination, and an implicit criticism of the applicability to mental affairs of some of the methods favoured by natural science?

At this point it is only fair to record that this methodological problem has not been the exclusive concern of psychoanalytical or clinical psychologists. The practice of concentrating on isolated aspects of behaviour (in the case of delinquency, the offence committed) to the neglect of what is usually called the "total personality" has been reprobated by a number of psychological schools. It is a mistake of which the law is notoriously guilty, however much the legal practice may be defended, on grounds either of social expediency or of social disapproval. And there is still less justification for it in the case of clinical psychology. But the psychoanalyst goes farther. He maintains that what is usually taken to be the total personality is also an *end product* which in ordinary circumstances does not give any clear indication of its origin, development and, still more important, its strength or weakness. And although psychoanalysts themselves have not yet established dependable criteria of psychic weakness or strength they have at least indicated the methods by which these criteria can be established. It is with these methods and with the conclusions based on them that we are now concerned.

In its simplest theoretical form the psycho-analytical approach to personality can be put in the following way. Assuming the existence of certain constitutional tendencies, the development of the personality is influenced by three main groups of factors the operation of which is to a large extent unconscious. The first in order of priority is a dynamic factor, namely, the vicissitudes of the instinctual forces with which the individual is endowed. These are regulated by a number of mental mechanisms, also for the most part unconscious, which sooner or later determine the individual's relation to the environmental objects of his instincts. This constitutes the economic factor. Finally, each successive stage in the relation to instinctual objects (in the first instance to the parents) influences the structure of the mind and gives a characteristic set to its component parts. These active structural components are sometimes loosely described as constituting the personality or character of the individual but, strictly speaking, personality includes the characteristic modes of mental operation (mechanisms) which in turn vary according to the characteristic stresses of instinct which the mind is concerned to discharge or control. *All of these three factors vary from person to person.*

Add to this the fact that the most decisive mental patterns, *i.e.*, those most prone to compulsive repetition throughout life, are those established in early childhood when the force of individual and environmental circumstances first opposes the free play of primitive instincts, and when in consequence characteristic, but mostly unconscious, mental content (phantasy and wish-formations) is formed, and it is not hard to see why the psychoanalyst regards behaviour as an end-product of the passage of mental forces through an elaborate apparatus. What is not so clear is that although, observing the behaviour of two individuals, the end result may appear to be identical the antecedent mental processes may vary widely. Not only so, judged by the strength or weakness, by the rigidity or elasticity of the processes, there is no guarantee that the two individuals will continue to manifest the same end result.

Applying these theories to the problem of the "controlled" survey, as when we examine and contrast a delinquent and a non-delinquent group, however carefully matched they may be in some respects, we are in a sense controlling one unknown with another. Selecting at random any two of the non-delinquent group and submitting them to a process of careful analytical observation over a prolonged period we might well find that in one case the absence of delinquent conduct was the result of a long and firmly established character (or conscience) formation, whereas in the other it represented an uneasy balance of forces and mechanisms which might be disturbed by any unusual stress. And *mutatis mutandis* similar observations might well be made regarding any two of the delinquent group.[4]

To put this in simpler clinical terms: if we limit our investigation to behaviouristic data, we have no immediate means of distinguishing between for example a "latent" delinquent who is apparently law-abiding and a true or stable non-delinquent. This has a special relevance to controlled studies of psychopathy. What proportion of the law-abiding population is fundamentally psychopathic in make-up has never been accurately determined. But psychoanalytic experience of random samples of apparently normal people suggests that it is by no means negligible. Just as it is difficult to differentiate advanced psychopathy from a schizoid character, so is it hard to distinguish a latent psychopath from a normal person. As we know, even criminal psychopaths may present many normal or conventional facets to their character, and are frequently regarded by their familiars as normal, even attractive, types.

An even more intriguing situation exists in the case of some forms of homosexuality. Roper (1951) has pointed out that homosexual offenders coming under his observation in prison were in other respects law-abiding, well-behaved and worthy citizens. To which it might be added that study of unconvicted homosexuals in private practice shows that many of them are not only of a high cultural level but that, sexual behaviour apart, they maintain the most exacting ethical standards. In short, when arranging for non-delinquent adult control groups it would not be a bad plan to select a proportion from amongst certain types of non-conflicted homosexual on the grounds that their normal (law-abiding) characteristics present a high degree of stability!

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[4] This incidentally explains why it is important in all clinical examinations to study with care the "precipitating factor," the trigger impulse or situation that touches off the delinquent conduct. Not of course that a trigger impulse itself provides the observer with an all-round theory of causation. What it mainly indicates through its strength or weakness is the state of balance of the underlying forces.

To all this there is an apparently simple answer, *viz.*, to select control cases on the basis of more thorough examination and thereby reduce sources of error. This is indeed a policy followed in varying degree by those who employ predictive techniques in which some hundreds of items are reduced to what appear to be the most significant groups of factors. These scales are then applied to the cases to be tested.[5] No doubt if similar checks were applied to all control groups by psychological and sociological investigators the scientific status of "controlled" investigations would be greatly increased. In some recent work attempts have been made to apply psychoanalytical findings in the formulation of delinquency questionnaires.[6] But so far it cannot be said that the practice is generally followed or that it is applied with equal particularity to both delinquent and control groups. Even if it were, the problem would still not be solved. For unless the various scales and tests applied were supplemented by clinical examination in which direct interpretation of unconscious factors was employed, and some accurate means of quantification of basic factors applied, we would still be left with considerable uncertainty as to the validity of the control system.

And here we may return to the point raised earlier in this communication, namely, that even after controls have been applied the conclusions arrived at must be interpreted in terms of the total dynamic situation. In the absence of such interpretation we cannot fairly assess the validity of the statistical conclusions. This view has an interesting corollary, namely, that *whilst the conclusions arrived at by means of a control system may support an existing hunch regarding the causes of delinquency we have no sound justification for abandoning a causal theory simply because the application of statistical controls appears to show that it is non-specific.*

Admittedly this is a somewhat disconcerting conclusion. On the other hand, the functioning of mind is of its nature profoundly disconcerting. Not to put too fine a point on it, when allegedly scientific procedures appear to point conclusively in one direction, the investigator of deep and unconscious factors should not allow himself to be too perturbed if these conclusions run counter to his own interpretations. Although apparently wrong by customary scientific standards, he may still be right by the standards of depth psychology. It would immensely improve our measures of investigation, if, whilst admitting the desirability of adequate "control," we refused to allow ourselves to be intimidated by existing statistical disciplines. To express this in a more uncompromising way: the study of delinquency is still at a stage when the detailed investigation of a few uncontrolled cases can be extremely fruitful. This has always been a feature of psycho-analytical investigations. Granted that interpretations of unconscious factors are subject to a wide margin of error, they may nevertheless uncover a greater number of significant etiological factors than the most meticulous "survey" of the factors manifest in a large number of collected cases. Actually Freud was able to establish some of the most important laws regarding human behaviour on the strength of isolated observations of unconscious function. To the natural scientist the isolated and uncontrolled observation appears to be the most vulnerable of all scientific data; yet, as psychological history has shown, it can have a validity transcending that achieved by the study of large groups. It acquired this validity because psychoanalysts have never been content to take mental phenomena at surface value but seek always to extend the deeper factors governing human behaviour. Depth rather than numerical extension of observations has been the consistent policy of the dynamic psychologist.

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[5] In the work of the Gluecks, for example, three final tables were constructed from over 400 items, *viz.*, a "character structure" scale, a "social background" scale and a "psychiatric" scale, the last being based largely on Rorschach tests.

[6] See Bonnard (1955), Grygier (1955, 1957, 1958), Holt (1958 and 1960), Krout and Krout-Tabin (1954), Loevinger (1957).

One last consideration. I have maintained that when investigating the causes of delinquency, the practice of contrasting offenders with (in the delinquent sense) "normal" cases is subject to error or at least is much less fruitful than might appear. But the argument does not end here. In fact we understand "normality" much less than we do delinquency. One of the main flaws in the investigation of delinquency is precisely that we do not fully understand why non-delinquent individuals are non-delinquent. We might indeed go so far as to say that we will never grasp the essential causes of delinquency until we solve the infinitely more complicated problem of "normality." And this will involve an extremely elaborate classification of normal types together with a detailed interpretation of the variations in the developmental processes responsible for them. Until this is done the use of the "control" case as practised at present will remain an uncertain measure.

We must recognise, however, where this argument leads. The clinical psychologist studying a variety of offenders has been bold enough to isolate what he called types of "pathological delinquency." But he has claimed no authority in the case of "responsible crime," *i.e.*, in the case of offences where no pathological factors can be detected. This he delegates to the social psychiatrist or sociologist who in any case is compelled by his techniques to take all forms of crime as his province. By so doing the clinical psychologist has played for safety in diagnosis. But he cannot rest content with this situation. Clearly he must endeavour to establish the frontiers of pathological delinquency, that is to say, how far the apparently law-abiding population is infiltrated either by latent delinquents or by pathological delinquents who have sufficient discretion not to be found out. In my opinion the first and most convenient step in this direction is to scrutinise with the greatest care the criteria leading to the selection of the "control" case.

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NOTES

THE PARASITE LAW IN THE SOVIET UNION

R. BEERMANN

IN the USSR the law "On the intensification of the struggle against persons who avoid socially useful work and lead an anti-social parasitic way of life," in short the "parasite law" (in force in the RSFSR since 4th May, 1961) deals with socially ineffective and (in a more general sense) with socially undesirable persons rather than with criminals as such. The law is interesting because it gives an indication of the type of persons and activities that it is anxious to deal with. But it is of further interest because it shows how a new and rather controversial norm was introduced and implemented by the different Union Republics of the USSR.[1]

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[1] For surveys of the drafts and laws and the associated discussions see *Soviet Studies*, Vol. XIII, Oct., 1961, No. 2, pp. 191–205, Vol. IX, Oct., 1957, No. 2, pp. 214–222 and Vol. XI, Apr., 1960, No. 4, pp. 453–455. The new law of the Russian Republic

The quotation "who will not work shall not eat" (2 Thessalonians, 3, 10), explicit in the "parasite laws" of all the Union Republics comprising the USSR, has been used amongst others by St. Paul, Marx and Lenin and by the present (1936) constitution of the USSR and that of the Union Republics, all striving for a new way of life based on new ideologies.[2] Both the Pauline and the Marxian ideologies aimed at a radical democratisation of life with a revaluation of former values. Such changes are bound to create great ambiguities and uncertainties, causing at least for some people considerable anxieties. The sphere of the personal freedom of the individual in his relations with others and with institutions is greatly changed. The borders of that sphere circumscribed by the moral order and the law are shifted, and their outlines are by no means so noticeable and visible as they were. Such a situation must leave a number of persons beyond the pale of socially effective or socially approved life. New offences, hitherto unknown, will be committed, or the anxieties may render some persons incapable of participating in work altogether. Such anxieties and uncertainties will not only influence the criminal and the socially ineffective fringes of society; they will also affect the rulers whose ideology is impeccable. There are a number of ways open to cope with such situations. Law as such may be abrogated and behaviour assessed in its relation to the ideology. If a criminal code is implemented the application of analogy may be permitted, or a government by command may be introduced with a strict adherence to the leadership principle and a strict hierarchical subordination, enforced by special tribunals and police. All these ways, separately or in combination, have been applied in the USSR at one time or another. After Stalin's death and particularly after the 20th Party Congress (1956), a greater stress was laid on "socialist legality." This may be interpreted as application of the rule of law with due concern for the Marxist-Socialist character of the country.

The RSFSR Criminal Code (CC) of 1926 (abolished 1st Jan., 1961)[3] and the Basic Principles of 1924[4] provided for the use of analogy in two instances: Art. 3, par. 3 of the Basic Principles and art. 16 of the CC of the RSFSR provided that a socially dangerous action, if not mentioned in the Code,

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appeared in the official gazette, *Vedomosti Verkhovnovo Soveta RSFSR*, No. 18, 1961. The official gazettes of the other Union Republics are not available. Their versions of the new law appeared in their press, as follows: *Pravda Vostoka* 18.5.61—Uzbek Rep.; *Sovetskaya Belorussiya* 16.5.61—Belorussia; *Sovetskaya Litva* 28.5.61—Lithuania; *Sovetskaya Estoniya* 11.6.61—Estonia; *Turkmenskaya iskra* 2.6.61—Turkmenia; *Pravda Ukrainy* 13.6.61—Ukraine; *Zarya Vostoka* 15.6.61—Georgia; *Kommunist* 18.6.61—Armenia; *Sovetskaya Moldaviya* 30.6.61—Moldavia; *Kommunist Tadzhikistana* 3.8.61—Tadzhikistan; *Kazakhstanskaya pravda* 7.8.61—Kazakhstan; *Sovetskaya Latviya* 19.8.61—Latvia; *Sovetskaya Kirgiziya* 29.9.61—Kirgizia; *Bakinski Rabochi*, 7.6.61—Azerbaidzhan.

[2] Constitution of the USSR, art. 12, and the corresponding articles in the constitutions of the Union Republics.

[3] We refer basically only to the CC of the RSFSR, *i.e.*, Russia proper, as the codes of the other Union Republics differ from it only slightly.

[4] *Ugolovnoye zakonodatelsto SSSR i Soyuznykh Respublik*, Moscow 1957, pp. 7, 11, 41 (art. 16 of CC RSFSR) and the corresponding articles of the codes of the other Union Republics in the same volume. A synopsis is given on p. 457.

may be punished according to that article of the Code whose definitions are nearest to the dangerous act committed. The other rule was contained in article 22 of the Basic Principles of 1924 and stated *inter alia* that a person could, even if not found guilty of particular crimes, be exiled for three to nine or one to five years if found to be socially dangerous or to maintain socially dangerous (criminal) connections.

Both these provisions became increasingly unpopular, particularly among Russian lawyers and members of the Procuracy. Article 22 fell into disuse and the new Basic Principles of 1958/59 and the CC of the RSFSR of 1960/61 do not contain provisions for the use of analogy. On the contrary the CC satisfies one requirement of the rule of law by its legal definition of crimes as acts mentioned in the special part of the CC.[5]

It is interesting to note that simultaneously with this trend towards legality another movement was noticeable which demanded greater powers to deal with deviants. Starting in the first half of 1957 the Union Republics published in their daily press for public discussion draft laws of legislative commissions of their Supreme Soviets " on intensification of the fight against anti-social parasitic elements." [6] In the lengthy preambles of the drafts it was stated that this law was meant to deal with people who live on unearned incomes and avoid socially useful work. The drafts divided the idlers (persons living on unearned incomes) into two categories: (a) persons not working, or if working then merely for the sake of appearance, with a permanent residence; and (b) persons living likewise on unearned income but without a known domicile. The first were to be dealt with by general meetings of the local public, the second by the ordinary Courts of Law (the People's Courts). The sanction common to both categories was exile for two to five years. This referred to adult able-bodied persons. The disabled and elderly among the two categories could be placed by law in institutions.

Only eight of the fifteen Union Republics, mainly those in the Asian parts of the USSR, passed the law, while the other seven—including the RSFSR, Belorussia and the Ukraine—abstained.

The drafts were subjected to considerable criticism. Although most participants in the discussions regarded a measure against parasites as necessary, many, particularly members of the law schools and the Procuracy, expressed doubts as to the effectiveness of the measure and its correspondence with the rule of law (" socialist legality ").

For almost three years nothing much happened, except that the Georgian Republic adopted a rather mild and abortive measure for the exile of idlers for between six months and two years by order of the Executive Committees of the local town soviets. Country dwellers were not mentioned at all. Nevertheless the general campaign against parasites, idlers, speculators, etc., continued in the daily press of all the Union Republics, demanding special measures and publicising instances of undesirable gainful activities.[7]

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[5] See Basic Principles of Criminal Law (substantive) in *Sotsialisticheskaya zakonnost* No. 1, 1959, p. 101 (art. 7); see also art. 3 and 7 of the CC of the RSFSR in *Zakony RSFSR i postanovleniya Verkhovnovo Soveta RSFSR* (published by the Supreme Soviet of the RSFSR, 1960) pp. 59 and 60, and the code of Criminal Procedure (*ibid*) art. 4, p. 163.

[6] See *Soviet Studies*, Vol. IX, p. 214 and Vol. XI, p. 453 for reports on the old parasite laws and their drafts.

On 4th May, 1961, the Presidium of the Supreme Soviet of the RSFSR (the Presidium is the legislative organ of a Supreme Soviet between its sessions) passed a decree (Russian word *Ukaz*, used for laws decreed by a Presidium, while legal enactments directly passed by a Supreme Soviet are published as laws, *zakony*) entitled "On Intensification of the Struggle against Persons who avoid Socially Useful Work and lead an Anti-social Parasitic Way of Life." The Presidiums of the other Union Republics, including the eight which had already accepted the original drafts, all followed suit with very similar decrees. Only in the Estonian Union Republic was the law on parasites passed directly by the Supreme Soviet.

All these new enactments, which differ only in minor details, have little in common with the original drafts of 1957/58. Many of the objections raised in the public debates on the drafts have now been met. The doubts expressed as to the legality and effectiveness of gatherings of the public as special forums with power to exile are partially met by strengthening the part played by the Law Courts and by the Procuracy. The old division of the idlers into those with or without domicile is dropped. According to the new laws the District or Town People's Courts acquire exclusive jurisdiction in respect of the category of able-bodied adults who neglect their constitutional duty to work according to their ability and who draw unearned income from commercial use of land allotments, motor vehicles or dwellings, or commit other anti-social acts which enable them to lead a parasitic way of life. The People's Court may exile such persons to places appointed for that purpose for a period of two to five years. The property thus acquired is subject to confiscation orders. At their place of exile the offenders must take up socially useful work. A second category of offenders who are subject to the jurisdiction either of the People's Courts or of public meetings (at factories or other places of work) is defined as persons who are in socially approved employment, but for the sake of appearance only and who in actual fact function as private entrepreneurs and derive their living from unearned income or commit other anti-social acts for the sake of unearned gains. The sanctions are the same as in the first case. The decisions of the Courts are final, while those of the public meetings require confirmation by the Executive Committees of the District or Town Soviets. Before proceedings can be started, the idler must be warned by some official or public body. Preliminary investigations are necessary and are conducted by the militia (police) and supervised by the Procuracy. In order to initiate proceedings, the sanction of the local Procurator is required: he has discretionary powers, in respect of the second category of idlers, to deposit the case with the Courts or to submit it to a public meeting. The exiled person who disobeys the work order may be sentenced to corrective labour with 10% deducted from his normal earnings. Further disobedience is punished by imprisonment (art. 28 CC of the RSFSR). The time served in corrective labour or imprisonment is not deducted from the term of exile. Escapes from the place of exile make the offender punishable in accordance with article 186 of the CC of the RSFSR. After at least half the term of exile has been served the rest of the sentence may be remitted if such remission has been sought by public organisations of the place of exile and agreed by the Executive Committee of the District or Town Soviet of the idler's former place of residence. If parasite proceedings disclose the commission of a crime, the files are submitted to the local offices of the Procuracy for further action according to the norms of the criminal laws (substantive and procedural).

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[7] Reported in *Soviet Studies*, Vol. XIII, pp. 191–205.

Such differences as exist between the parasite laws of the Union Republics are now as follows. The Estonian and Ukrainian laws provide that " malicious alcoholics (persons who due to their addiction cause distress and unhappiness to their families and immediate neighbourhood) " may be subjected to compulsory treatment. Their earnings can if necessary be paid directly to their wives or to specially-appointed trustees. The Estonian law included another rather harsh-sounding measure, that the Executive Committees of the local soviets can decree the confiscation of the property of a disabled person if such property was acquired by anti-social acts at the expense of the state or of private citizens.[8] A disabled person (if thereby left without means) may be sent to a home for the disabled. The Estonian code has the further peculiarity that it provides for alternative jurisdiction by either Courts or public meetings for both categories (see p. 74) of parasite. The Georgian law has alternative jurisdiction by Courts or by Executive Committees of the local soviets for the first category of idlers, whilst the second category is dealt with in the same way as in the Russian (RSFSR) law. If confiscation of property is in question, jurisdiction according to the Georgian law is given to the Courts exclusively.

We see that between the drafts of 1957 and the laws of 1961 there are vital differences. The categories of offender to whom the law applies have changed. If in the 1957 drafts the real "ne'er do well," the "grey-scrubber," as well as the tramp and beggar were still conspicuous, their existence is merely implied by the new laws. Even the special jurisdiction which the old drafts provided for persons without a domicile does not apply any more. The new law is concerned rather with the more prosperous categories, those who are not rendered ineffective due to their anxieties, but on the contrary are exploring the new regions of freedom and in that way fall short of the moral injunctions of the doctrine or the legal enactments.

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[8] *Sovetskaya Estoniya* 11.6.61 or *Rahva Haal* of the same date.

All the new post-Stalin reforms were directed towards greater liberties for the citizen, thus giving the impression of greater permissiveness. Simultanously with these liberalising tendencies, the seven-year economic plan was instituted (beginning in 1959) and it was proclaimed that the country had embarked on the second stage of its development, the building of a fully Communist society. These conditions of more liberty on the one hand, and on the other hand intensification of demands for greater moral strength and purity and harder work, made for greater intolerance of sexual vice and a sterner view of the idler, the profiteer and persons enjoying conspicuous consumption without "known" sources of a corresponding income.

The only socially approved means left for social and material advancement in the USSR are personal talent, skill and education. Education is of course the most effective and is one of the explanations for that great urge for knowledge and learning apparent to any visitor to the Union. The possibility of setting up in private business does not exist. There are only a few crafts left which can be pursued by single craftsmen on special licence. Up to 1960 one still had the opportunity to be a member of a craftsmen's co-operative. But in accordance with a decree of the Government of the USSR of 1956, such co-operatives were gradually absorbed into state or local government industries.[9]

The bottlenecks which still exist in the supply of some consumer goods, tools and raw materials are a constant inducement to act as manufacturer, distributor or purveyor by illicit means. The small land allotments possessed by collective farmers, state farm employees and many town dwellers, produce considerable quantities of marketable goods, particularly meat, milk, eggs and garden produce. Probably as much as a third of the Soviet food supply is produced in this way.[10] Although much of it is consumed by the producers, much also gets onto the market. Legally such produce may be marketed only as one's personal surplus, by direct sales from producer to consumer in the kolkhoz (collective farm) markets or via the co-operative sales organisations. But the producer is not always able to market his own produce and the co-operatives restrict profits to the legal minimum, without due consideration for particularly favourable market conditions (spring vegetables, early tomatoes, etc.). These conditions attract a number of people to act as distributors, or as both distributors and producers of such goods. There are also frequent reports in the daily Press of instances of "underground capitalism," of illicit factories such as a lipstick factory in Moscow, a leather factory (in actual fact underground) in Tartu (Estonia), a carpet manufactory in the Soviet East. These were all detected, and the owners charged and prosecuted, but their existence justifies the conjecture that there are a considerable number of undetected or locally "permitted" speculators, manufacturers or tradesmen. Some may be well protected from detection due to the closed circuit character of their businesses, where manufacturers, distributors and consumers are a closed group of persons with common interests and common loyalties. In particular, this applies to illicit stills in rural districts. There are reported instances where even the collective farm management has assigned considerable quantities of grain to illicit distillers for the manufacture of "samogon" (home-distilled vodka). The greater the need and demand for certain goods, the less likely the detection of supplier or manufacturer. Likewise, privately owned houses and summer-houses are let at rents far exceeding the permitted amounts.

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[9] Excerpts of the order are given on p. 186 (see also footnote) in *Istochniki sovetskovo grazhdanskovo prava* (Moscow 1961).

[10] See, *e.g.*, J. A. Newth in *Soviet Studies*, Vol. XIII, pp. 160–171 and 414–432. In recent years, of the total supply of foods in the USSR approximately 40% of the meat, half the milk, 80% of the eggs, two-thirds of the fruit (other than citrus) and half the potatoes and vegetables were produced in private rural and urban allotments. These allotments amount to under 4% of the sown area of land in the USSR. Thus the strain on the concept of the superiority of the public sector of production, as distinct from the private or personal, is very great.

The Parasite Law opens a possible avenue to stop such dealings even if there is not sufficient evidence available to start criminal proceedings. The authorities may proceed against the suspected profiteer on account of his "conspicuous consumption," unexplained by his lawful means and earnings. Such proceedings may even supply the evidence needed for a prosecution according to the criminal law. The recent frequent reports in the Soviet Press and legal periodicals of prosecutions for speculation on the grand scale in currency and goods, for illicit trading, for underground manufacturing, all indicate that the "parasite law" may have contributed to the detection of these criminal offences.[11] Bribery and large-scale embezzlement and fraud in respect of State property have been particularly conspicuous in the Eastern republics. The feudal and patriarchal life of these peoples belongs to the quite recent past and is still noticeable in many institutions and habits. We are not in possession of the criminal codes of these republics but the CC of the RSFSR (1961) with its Chapter 11, articles 231–236, providing special sanctions against tribal customs, such as tribal feud, payments for brides to their parents (*kalym*), abduction of brides, etc., is significant because it states explicitly that chapter 11 is to be applied in regions where the offences mentioned are regarded as local customs. The RSFSR contains many regions similar in population and cultural development to these Eastern republics. Differentiation between civil and criminal offences is generally a late cultural development. A patriarchal way of life is not conducive to the internalisation of norms of conduct. These remain somewhat external and conduct is governed by tradition. One obeys the commands of the elders or their councils, and lives in accordance with one's customs. Such factors are conducive to regarding the higher official or executive not merely as the person endowed with functional legal powers (the state official) but as a man of patriarchal qualities who even ought to be placated by free gifts and an obedient, perhaps obsequious, attitude.[12] Such feudal tendencies have surely been reinforced during the dictatorial periods of Stalin's rule. The liking of the Easterner for more display and decorative surroundings may betray his unearned income to a greater degree than that of his European counterpart.

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[11] See footnotes in *Soviet Studies*, Vol. XIII, pp. 204–205 for references regarding private illicit trading and manufacturing. On currency speculators in Georgia see *Zarya Vostoka*, Dec. 4, 1961, p. 4; *Izvestiya*, No. 26, 1961 reports on an illicit tulle factory (for an English version of this report see *Current Digest of the Soviet Press*, Vol. XIII, No. 47, p. 40). The underground leather factory is reported in *Sovetskaya Estoniya* 14.5.61. As to the conspicuous houses owned, see *Izvestiya* 11.6.61. See also *Sotsialisticheskaya zakonnost*, No. 3, 1962, pp. 46, ff. about a carpet factory and private pig farm.

The parasite law is meant to change the social climate, to function more as a preventive measure, to create an attitude, intolerant of private profiteering and unearned gains. But with its wide definitions and procedural irregularities it definitely weakens the rule of law.

The demand for the rule of law is expressly stated in arts. 4 and 7 of the Basic Principles of Criminal Procedure (December 25, 1958), which lay down that nobody may be prosecuted for a crime otherwise than in accordance with the rules defined by the law, and that the courts are the only juridical institutions for criminal proceedings. This difficulty is overcome in a purely semantic way, by the statement that "parasite proceedings" are administrative proceedings and involve administrative measures. The gravity of the interference with the freedom of the subject contradicts this statement. This is particularly so in view of the fact that offences of a similar character are subjected, according to the Criminal Code, to more lenient treatment (a second offence of "unlawful trade" is punishable by corrective labour up to one year, or a fine up to 20 roubles, whilst for the first offence an administrative fine is provided).

The number of reports in the daily Press and periodicals testifies to the frequent application of the parasite law. Being, however, rather an ambivalent measure, it has not always produced satisfactory results. As may have been expected, the Procuracy officers have preferred the courts and not the meetings of the public for the exile proceedings. The meetings of the public have usually summoned the offender in order to warn him formally, while the exile proceedings proper have been given to the courts. Public meetings, the militia, the local Procurators, the local government authorities, all of whom in practice are concerned in such warnings, have been reminded in the legal periodicals and in the daily Press to grant to the offenders sufficiently long periods of grace for finding employment and starting work. A few days or a week, it is pointed out, are by no means sufficient. Another difficulty mentioned in the Press has been the reluctance of managers to employ such persons, an experience also common with discharged prisoners in the USSR.

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[12] See the interesting book on Muslim and tribal law in *Ugolovnoye obychnoye pravo Kazakhov* (Criminal Common Law of the Kazakhs) by T. M. Kulteleyev, Alma-Ata, 1955.

From a statement by the Assistant Procurator of the Estonian Republic, we know of such other sources of parasitic income as "prostitution, speculation in foreign goods and the illegal performance of religious rites." In his newspaper article he stresses that only property acquired by means of unearned income is subject to confiscation orders, that parasites will have to be employed in industry, agriculture or the building trades, and that the authorities should be particularly careful with regard to confiscation of the property of the elderly and disabled, since the parasite law is mainly directed against able-bodied adult persons, and the authorities should not trouble unnecessarily the elderly and the disabled. (In the USSR men over sixty and women over fifty-five years of age are eligible for pensions.) In a number of articles published in other Union Republics the officials of the Procuracy have likewise stressed that the parasite law is concerned with able-bodied and adult persons. Such statements have been necessary because instances have been reported of persons who are unable to work due to physical or mental ill health, pregnant women and mothers with children arriving at the places of exile. Some instances of juveniles (under eighteen years) having been exiled are also reported. The articles stress that such persons should be subjected to admonitions by public meetings or to other educational measures, for the law explicitly excludes them from parasite proceedings.

As to the courts, their procedures likewise have not always conformed to the requirements of the law. The judges are reminded that parasite cases must be heard in full session with both Assessors present, that the offender must be given an opportunity for explanations and, if necessary, witnesses ought to be summoned for evidence.[13]

It is interesting that the new criminological tendencies in Russian law and legal practice require the judges and other authorities to find out about the causes, conditions and circumstances of the offences committed, including the personal reasons of the offender. The "parasite laws" seem not to conform to this requirement by their too general and simplified definitions such as "idleness" and "unearned income."

In summing up one can say that the law represents an interesting attempt to deal with the marginal elements between the socially approved and the clearly criminal; at the same time it is aimed also against undetectable crimes by making it an offence to live on income not derived from work or other legally approved pursuits. The Ukrainian law formulates this in an even more explicit sense by stating that those who "manifestly live beyond their earned incomes" and likewise "persons with an unconscientious attitude towards their work" shall be made subject to parasite proceedings.

The range of persons involved according to the law is rather wide, comprising the ne'er-do-well, the man or woman unable to cope with the requirements of modern society, and individuals of a highly agile and active character who, far from being idlers, are explorers of the regions of freedom and by such activities find themselves beyond the pale of permitted behaviour. Many of the "parasites" in the interstices of the clumsily planned economy are of real economic benefit to the country.

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[13] *Sovetskaya yustitsiya* (Soviet Justice—the legal periodical of the RSFSR), No. 3, 1962, p. 19; *Sovetskoye gosudarstvo i pravo* (Soviet State and Law—the legal periodical of the Institute of State and Law of the Academy of Sciences of the USSR), No. 3, 1962, pp. 133–135.

From a criminological as well as a legal point of view the law is unsatisfactory. It condemns out of hand a variety of activities, or inactivities as the case may be, under general and ill-defined attributes while the rule of law would require strict and precise definitions. The legal and constitutional difficulties are overcome in a purely semantic way by defining procedures according to the "parasite law" as administrative measures or measures of "public influence," in spite of the gravity and significance of the sanctions involved. The law has only three sanctions for a diversity of activities: (1) public warning followed by (2) exile with compulsory labour and, if necessary (3) confiscation of property. The exile from two to five years is rather a rigid measure and is regarded as not subject to further judicial discretion. (In a case where the offender was exiled to a term of less than two years, the judge was reminded that such discretionary powers do not exist.)

It is clear from published reports that not all exiles are reformed. On the contrary, some did not take to work. This has induced observations that it may be wrong to exile idlers to common residences and that it may be more appropriate to disperse them in order to eliminate mutual reinforcement of a contempt for work. There have of course been others who did very well. Another complaint has been raised against the authorities, who, it is said, are more liable to proceed against those who do not work and to neglect that rather important category of persons who, although in a job, use it for the sake of appearance only. Here the law of least resistance seems to be in operation.

In general it seems that public opinion in the USSR is in favour of the law. It is perhaps a justified generalisation that the idler and profiteer are more conspicuous and regarded with less tolerance among a hard-working community, mainly engaged in manual and physical labour, than among people in artistic and intellectual pursuits. A society that intends to establish a new order is more prone to be intolerant than one that mainly adheres to traditional ways. Hence the interesting parallel between St. Paul and the more contemporary statements. All were intending to establish a new order and a new society.

The "parasite law" should be viewed in the light of the size, the diversity of cultural and ethnic background and the dynamic aims of the USSR.

NOTES

PROBATION WITHOUT PROBATION OFFICERS *

GORDON ROSE

IT is somewhat difficult to write anything about this report for an academic journal, for there is little in it which will be of considerable interest to those who are concerned with probation as a legal provision or as a method of treatment. Furthermore, in what little there is, and it is mainly a matter of detail, the Departmental Committee on the Probation Service has been scooped by the Reports of the Ingleby[1] and Streatfeild[2] Committees which appeared before it. There has been little real criticism of the legal provisions upon which probation rests, or of the administrative organisation of the service (always excepting Scotland, where there are problems in every sphere). What has really roused feelings has been recruitment, training and pay (which, of course, go together), and the result is that the most controversial parts of the report are concerned with the status and future of probation officers rather than what they do. Those, therefore, who have no interest in the professional or administrative aspects need not read much farther.

In fact, one is left with the feeling that except in matters of detail the legal basis and administrative operation of the system in England require little alteration, and, because of this, much of the Report can only be described as " supportive." Thus there is a clear statement that the probation officer should be regarded as the court's general social worker, and that he requires general casework skills. This is spelled out in some detail and is obviously intended to convince the uninitiated—still unfortunately to be found in some courts. The Committee also agree with the Streatfeild Committee that pre-trial inquiries are permissible if the accused has had an opportunity to object and has not done so; and that a probation officer may recommend on suitability for probation, although they seem reluctant to go quite as far as their predecessors upon what the officer might say about other methods of treatment. Similarly, they endorse the view that after-care should not be regarded as extraneous to the work of the probation officer and should be counted as part of his case-load when making up establishments and supervised in the same way as the rest of his work.

Turning to administration, the Committee uphold the present system of probation committees having no direct responsibility to a local council, on the grounds that it appears to work without difficulty (one wonders if probation offices would be quite so ramshackle if the council had direct responsibility, but there seems to be little advantage in adding councillors where these are (unusually) absent, and the close links between probation

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* Report of the Departmental Committee on the Probation Service, 1962 (Cmnd. 1650), H.M.S.O., 10s.

[1] Report of the Committee on Children and Young Persons, 1960 (Cmnd. 1161).

[2] Report of the Interdepartmental Committee on the Business of the Criminal Courts, 1961 (Cmnd. 1289).

officers and magistrates need to be preserved). They also reject the suggestion that there are grounds for criticism in the way the Home Office has carried out its work, pointing out, reasonably enough, that the rapid increase in crime, and the inequalities of wage restraint have made the task of the Home Office particularly difficult in recent years, and that it is in the areas of pay and recruitment that symptoms of strain between the centre and the localities have appeared. The Committee are also strongly in favour of further combination of areas, maintaining that any area which cannot sustain a staff of six (excluding the principal) ought to be combined. This will strengthen the arm of the Home Office to some degree, but no new powers are suggested. On case committees, the Committee endorse the general view that an expert service cannot be supervised by laymen and that these committees should thus be regarded as no more than a general informational link.

In this general sphere of control and administration there are, however, two rather more important sets of recommendations. One is that the Home Office should relinquish detailed financial control and should retain its influence largely by the " key control " of establishments. This is very much in line with the general trend towards local autonomy, instanced by the Local Government Act, 1958, and the gradual loosening of capital controls. It will probably make little difference except in the case of the smaller authorities, and this in itself underlines the need for more combination. One small but important point is not mentioned: could something be done to ensure that probation officers get their expenses when they visit institutions? This is an essential part of good after-care.

The other is that the administration of the London Probation Service should be brought into line with those elsewhere, that is, detached from the Home Office and put under an independent probation committee. The Committee thus responds to the strong feeling that Home Office administration is remote and uninterested. The Committee does not seem to have considered the new situation which will be created by the reorganisation of London government—not even as a prospect. They happily suggest, for instance, that the expenses of the probation committee, subject to the 50 per cent. grant, should be met by the London County Council, presumably following the Royal Commission on London Government (para. 865), which recommended that the cost of the administration of justice should be borne by the Council for Greater London. The organisation of the probation service is not a function of local government and was therefore not considered by the Royal Commission,[3] but one might argue, just as the Royal Commission argued in respect of some other services, that the real trouble with the London Probation Service is that it is too large and that any administration over so wide an area would be remote. Should not the possibility of dividing it and making it co-extensive with the new boroughs be considered?

[3] Royal Commission on Local Government in Greater London, 1957–60 (Cmnd. 1164).

This is an appropriate point, perhaps, to say something about Scotland. Here both the law and the administration are somewhat behind the times, and the Committee makes a number of important recommendations designed to bring them more in line with England and Wales. Probation is used less in Scotland than in England and still tends to be regarded as a method of treatment exclusive to juveniles and to the lower courts, and the Committee felt that it could be used more extensively. They also suggested various amendments in statutes and procedure, *e.g.*, that Scottish probation officers should not be expected to send a copy of their report to the procurator fiscal or consult him before initiating proceedings for a breach; that the consent of an offender aged under fourteen should not be required, that Scottish orders should name the committee and not the officer; that the officers should play more part in after-care, at present largely carried out by school welfare officers; and that conciliation should be recognised as part of their work.

More important, the Committee recommends that the administration of the service in Scotland should no longer be by committees predominantly composed of local authority councillors and considered as part of the authority, but that there should be special arrangements for each area for a joint local authority and courts committee which would apparently be something like the Standing Joint Committees which administer police services in counties. The local authorities will thus continue to play a larger part, due to the structure of Scottish administration, but it will be less predominant. It is recommended that the appointment of case committees in each area should be made obligatory.

We may now turn to the real meat of the report: the recruitment, training and pay of the probation service. Probation, as a method of treatment, consists primarily of probation officers, a truism which was not in fact realised at the time of the Probation of Offenders Act, 1907. It was this belated discovery which led to the appointment almost immediately of the Departmental Committee on the working of the Act, which reported in 1909. From its report stems the National Association of Probation Officers (1912), and the realisation by those in authority that a new profession had been created. The conception of this new profession, its entry requirements, training and pay in relation to other similar professions has gradually been evolving. It was much helped by the report of the Departmental Committee on Social Services in Courts of Summary Jurisdiction in 1936, which virtually ended the division between missioners and probation officers and the dominance of the Police Court Mission in selecting officers, and which also cast the Home Office in the role of pacemaker and creator of standards for selection and training. The whole question has recently been brought to a head by the rapid increase in crime and the shortage of officers, but there is an underlying and equally important problem. This is the professional standing of probation officers in relation to the rest of the social work profession.

With the Younghusband Report,[4] social work has come of age in this country, but it has been established as a hierarchy in which there are two levels: the graduate and the non-graduate. It need hardly be said that, in the long run, this must inevitably affect pay; indeed it has already done so in the local government scales. It is thus a matter of some importance where and how the probation service fits into this system.

The present situation of the probation service can probably best be stated by reproducing two tables from the report (p. 103).

TABLE 1

Distribution of sizes of case-loads

Size of case-load	Number (excl. supervisory officers) of whole-time officers, England and Wales with case-loads of this size at December 31, 1960. Men	Women
under 20	38	17
21–30	17	72
31–40	32	145
41–50	116	142
51–60	211	74
61–70	245	19
71–80	158	4
81–90	70	3
91–100	27	1
over 100	18	nil
	932	477

TABLE 2

Qualifications on appointment of whole-time officers employed in England and Wales on October 31, 1961

	No.	%	
1. Degree or certificate in social science or mental health after a course of whole-time study at a university followed by Home Office training or university applied social studies course	468	26·7	65·9
2. Home Office training only	685	39·2	
3. Social science degree or certificate after a course of whole-time study at a university without Home Office training or university applied social studies course	68	3·9	
4. Teachers' training course or university youth leaders' course	5	0·3	
5. No relevant university qualifications (so far as is known) or Home Office training	523	29·9	
	1,749	100	

It is clear from the first table that case-loads for men are on the high side, whatever one's standards may be—indeed one cannot think what use an officer can be with a case-load of over 100 and it can only be hoped that at least some of these numbers are due to failure to close cases, or to large numbers of moribund cases. Furthermore, the average for men has been increasing recently, although the table in the Report which shows this is a little misleading since it only covers the period of falling crime figures (1953–55), and the subsequent period of rapid rise. In 1952, a peak year and the first year given, the average was almost the same as in 1960.

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[4] Report of the Working Party on Social Workers in the Local Authority Health and Welfare Services, 1959.

The Report also gives the proportion of direct entrants (*i.e.*, those taken on directly by probation committees without reference to the Home Office, who are almost invariably without prior training) as 45 per cent. in the period January 1, 1958, to October 31, 1961, but does not point out that the proportion has been rising alarmingly fast.

It is not very clear why, in Table 2, the first two items are bracketed, since the Home Office training alone is in no sense equivalent to the higher grade social work training of a university basic course followed by a university or specialised professional course. In fact 1 and 3 should be bracketed and this gives a higher-grade element of just over 30 per cent., which is very creditable and is similar to the situation in child care. There are also 40 per cent. with a lesser training, and 30 per cent. with none. The problem now arises as to how far the service ought to and could in practice be turned into one mainly consisting of the upper level. It has long been an argument of the probation officers themselves that the work is indivisible and that a second grade (à la Younghusband) could not therefore be accepted, and they have gone on to argue that the aim should therefore be a service mainly consisting of those trained at the upper level, and that any lesser training is, by implication, an interim measure. The Committee accept the argument that there cannot be two grades in the service, but, without actually saying so, reject the idea of a primarily upper-level service, assuming, as happens at present, that officers with different qualifications will continue to work amicably together. They say:

1. that the investigations of the Institute of Industrial Psychology have shown that a school certificate on higher level is desirable for entry; that no minimum standard should be rigidly applied " but we think that the normal standard for acceptance should certainly be no lower than that of the school certificate or the general certificate of education at ordinary level," though they add that a substantial element at a higher level will be needed for higher posts. This is the same conclusion as the Younghusband Report, *i.e.*, that the main body of workers should come in at " O " level, not at " A " level;
2. that it should be an aim of recruitment policy to recruit " a reasonable proportion " of graduates;
3. dealing with the student under thirty who is not a graduate they quote the conclusions of the Younghusband Report and approve participation in the new non-university two-year courses being organised

> by Colleges of Commerce, and under the Home Office for child care officers, in extra-mural departments. "Subject to any developments within the universities, probation students should whenever possible take a university training. It is, however, desirable to consider participating in or sponsoring two-year courses in colleges of further education and university extra-mural departments." For non-graduates aged over thirty they also recommend a two-year course (the present course lasts one year). Such candidates should now be considered for a possible university training also.

It may be bias on my part (and I was one of those who pressed on the Committee the impossibility of attaining a mainly university-trained service in the foreseeable future), but my own conclusion would be that the Committee have said gently but firmly that the probation service will primarily be a two-year trained, non-graduate service, with, however, a reasonable proportion of graduates. As with all other conclusions, with which I agree, this seems to me to be eminently reasonable.

When, however, we pass to the question of salaries a shock awaits us. The local authority associations refused to give evidence on this because they felt that the Committee was usurping the functions of the existing negotiating machinery. What they meant, of course, was that they feared that the Committee was likely to follow the Royal Commission on the Police in recommending a swingeing increase in salaries for which the local authorities would be 50 per cent. responsible. How right they were. Happily casting aside all the standards set by negotiating committees—"comparable occupations," "the rate for the job," "catching up with the cost of living"—the Committee say flatly that if sufficient officers are to be recruited the basic rate should be raised from £625–£1,025 to £750–£1,350. How these figures were arrived at we shall never know, and perhaps it is better that we do not. This is, of course, fundamentally illogical. If the maxima for a university basic plus professional grade, such as P.S.W.s and almoners, are £1,140 and £965 respectively, and for the mixed, but intended to be two-year trained, social worker grade in local authorities £975, these salaries are out of all proportion. What in fact the Committee is saying is one of four things: that they think that social worker salaries are far too low in general; that they think that probation officers' salaries need not be related to those of the other social workers; that, while probation officers' salaries should be related to those of other social workers, there are very special reasons for distorting this relationship; or, more cynically, that the Home Office is stronger than the Ministry of Health and there is much more likelihood that they will be able to maintain, and even improve upon, the favoured position they already occupy (not only for salaries, but also in the financing of the operations of the Central Training Council for Child Care and probation training as against the meagre provision for the National Council for Social Work Training—a source of much bitter comment in Parliament and out).

In saying this I should like to make it quite clear that I do not oppose increased pay for probation officers. Indeed if N.A.P.O. succeeds in due course, as seems likely from the tone of official pronouncements, presumably this will strengthen the hands of N.A.L.G.O. and the Staff Side of the Health Services Whitley Councils. What I would like to see, however, is some gradual approach in the social work sphere to a rational relationship between level of training and salary scales, so that we cease to trade on the vocational devotion which impels students to take a three or four year university and professional training and then obtain no salary advantage from it.

This note ought not to conclude without some special reference to the problem of direct entrants. This was one of the things which most disturbed those who gave evidence, yet, oddly enough, the Committee seems to have skated over it without any proper discussion. The questions raised do not only cover the need for some training for direct entrants who have none, a need now being tackled on a part-time basis by the Home Office and the London Probation Service, or the need to increase pre-entry training facilities in general. They are concerned also with the fundamental problem of the control of selection procedures. This is not discussed at all. Yet there is an immense difference between the carefully worked out selection procedure of the Home Office, and the direct appointment by interview, without any reference to these procedures, which obtains at local level. It is, no doubt, the Committee's hope that enough officers will become available through the Home Office scheme to make it unnecessary for local committees to appoint directly, but there are some committees who much prefer direct appointment and think very little of Home Office selection. It is very difficult to control this by the inspector's power of confirmation after one year, for even if there is no shortage, he is reluctant to throw out an existing officer unless that officer is very bad indeed. There seems a strong case for powers to insist that all applicants should go through the present central selection procedure, even if this means that regional administrative arrangements must be made.

Another point to which the Committee has devoted rather less attention than one would have hoped is the general organisation of training. It was strongly urged upon the Committee that training functions should no longer be dealt with by the Advisory and Training Board but that there should be a Central Training Council which would be an independent body with Home Office, professional and educational representation. In no other branch of social work does the Government not only select students but also provide and run training courses. The Committee rejects this on the grounds of the small size of the service and points out that it is open to the Home Office to make more use of outside training facilities.

It is doubtful, to my mind, whether this is the real reason. A much more cogent argument is that there will very soon be two large training organisations in the social work field: the Central Training Council for Child Care, which is heavily Home Office dominated and just as heavily Home Office financed, and the new National Council for Social Work Training with its associated Health Visitors' Training Council. Until the problem of financial aid is solved these two bodies will never coalesce, since it would obviously be absurd for the Home Office Council to give up its favourable position, but in fact many of the courses they run will be of very similar types. Indeed the ardent hope of many in the social work training field is that the courses will, in fact, be linked at ground level by creating active, well-staffed new departments of social work training at a number of colleges of further education.

In this situation it would clearly be more sensible for probation training to be handled as part of the general scheme of training linking it to one or the other of these Councils, but the Committee has clearly thought it politic not to raise this thorny question at present. Things, therefore, stay administratively as they are, but further developments in training courses are bound to bring probation training closer to the hierarchy of training courses in other fields of social work.

The Committee have now reported on the first part of their task. The second was to look at the approved probation hostel system. We shall look forward with much interest to their views on this sadly neglected part of our penal system, and hope that they are slightly more radical than the general tone of their first Report.

UNIVERSITY OF GLASGOW
RESIDENTIAL COURSE IN CRIMINOLOGICAL STUDIES
APRIL 6th–13th, 1962

J. A. MACK

THIS was the first course of its kind to be held in Scotland. Its object was to present current aspects of criminological and penological studies to a student body interested but not already learned in the subject. Forty of the sixty resident and full-time students were drawn from the services concerned directly and indirectly with penal practice. Others included senior members of Universities and a group of psychiatrists interested in research. The attendance of the latter was particularly valuable since the course touched only marginally on the medico-psychological aspects of crime and delinquency, these aspects being reserved for further courses which it is hoped to organise in the future. The Scottish Home and Education Departments, which gave strong support to the course from its inception, were also represented. Lecturers included Professor D. R. Cressey and Professor D. Garrity from the University of California and San Francisco State College respectively, Professor van Bemmelen from the University of Leiden, and Monsieur Marc Ancel from the University of Paris. Current research and operational developments in Britain were presented by Dr. Charlotte Banks, Mrs. C. M. Carmichael, Dr. M. Grünhut, Miss Patricia Hooper, Dr. Howard Jones, Mr. T. S. Lodge, Dr. Gordon Rose, Dr. D. H. Stott, Dr. Keith Wardrop and Mr. L. T. Wilkins. A valuable account of Scandinavian penal developments was given by Mr. Gunnar Marnell. Sectional lectures and seminars were organised under three heads: Group Studies, Current Research and Police Studies, the last of these being conducted by Sir Arthur Dixon, formerly of the Home Office. A large number of Sheriffs, Sheriff Clerks and senior police and probation officers attended special lectures in the first week-end of the course.

The course ranged widely in method of presentation and in the theoretical and practical conclusions presented. In this it may be said to have reflected with fair accuracy the current situation in criminological and penological studies. The statistical studies varied from a straightforward acceptance of the reliability of published figures to the more rigorous analyses now being developed. A particularly interesting account of work on evaluation now being conducted by the Home Office Research Unit drew the tentative conclusion that the way forward in penal practice would appear to be along lines that social workers have always recommended, *i.e.*, by means of treatments suited to the type of individual concerned as against treatments which are believed to be *generally* good.

Perhaps the most fruitful discussions were evoked by the studies presented on the social structure of prisons. The view, deriving from current U.S. studies, that the administration of large prisons is shaped or reshaped very largely by the prisoners themselves, and that the bulk of prisoners are neither deterred nor reformed by prison, is strange and unwelcome doctrine in this country. The initial reaction of discouragement among those directly concerned—" then it doesn't matter what we do "—was quickly followed by a growing disposition to consider the deficiencies of present systems of officer–prisoner communication. As a result discussion of the various projects of group work in this country and elsewhere became very vigorous. " Group counselling " is a chameleon term, embracing many different practices, and would seem to demand a more radical change of attitude on the part of prison officers than the bulk of them might find possible or desirable. But the broad impact of the course on those attending, very ably summed up by Dr. Grünhut in his concluding lecture on " Penal Reform on Trial," appeared to be both positive and satisfying. There had developed by the end of the week a climate of marked enthusiasm for the further exploration of the subjects treated. More generally viewed, the course has helped forward considerably the projects now under discussion to establish criminological research and teaching on a firm and permanent basis in one or more of the Scottish Universities.

A NEW JOURNAL

ARCHIWUM KRYMINOLOGII TOM I. WarszAWA 1960. Panstwowe Wydawnictwo Naukowe. 399 pp.

THE first volume of this journal, published by the Department of Criminology of the Polish Academy of Sciences and edited by Dr. Stanislaw Batawia, Professor of Criminology and Forensic Psychiatry at the University of Warsaw, appeared in 1960. It contains 362 pages of articles in Polish and an English summary of thirty-seven pages. The articles deal with the following subjects: Delinquency in Poland in the years 1954 to 1958 in the light of police statistics; 500 juvenile recidivists; Gangs of juvenile delinquents; The delinquency of young adults aged seventeen to twenty in Poland in the years 1951 to 1957; Young adult recidivists; Robbery and its perpetrators; Results of forensic-psychiatric examinations of 4,200 offenders. Although in the main limited to statistical surveys the volume presents an interesting picture of the development of post-war criminality in Poland. Only a few points can be mentioned here. While there were 26,471 robberies recorded in 1945, the numbers declined from 1947 onwards to 2,089 in 1950. A special examination was made in 1955 of 302 judicial records, and it was found that violence had been used in 73 per cent. of these cases and that 69·5 per cent. of the offenders were below twenty-six years of age. Out of 3,900 offenders examined psychiatrically between 1953 and 1957, 24·7 per cent. were found to be irresponsible, 23·1 per cent. to be of diminished responsibility, and 50·7 per cent. to be fully responsible; schizophrenia was one of the most frequent illnesses, present in 510 of the cases; psychopaths were, in principle, considered to be fully responsible.

H. M.

ESSEX PROBATION COMMITTEE.
ANNUAL REPORT OF THE PRINCIPAL PROBATION OFFICER FOR 1961

THE Report shows an increase of the probation cases remaining under the supervision of Essex probation officers from 1,133 in 1952 to 1,786 in 1960 and 1,926 in 1961. The percentage of persons (other than motoring offenders) placed on probation by Essex Quarter Sessions increased from 29 in 1952 to 38 in 1961, and at Assizes the corresponding figures were 10 per cent. in 1952 and 22 per cent. in 1961. "A very interesting development during the year was a pilot Adventure Course initiated and conducted by the London Police Court Mission for boys on probation," along the lines of Outward Bound Courses.

H. M.

BOOKS AND PERIODICALS

CRITICAL NOTICE

DELINQUENCY AND OPPORTUNITY. A theory of delinquent gangs. By RICHARD A. CLOWARD and LLOYD E. OHLIN. [Glencoe, Illinois: The Free Press. 1960. viii + 220 pp. $4.00; and Routledge & Kegan Paul Ltd., London, 1962. 25s.]

THE INSECURE OFFENDERS. Rebellious youth in the Welfare State. By T. R. FYVEL. [London: Chatto & Windus. 1961. 347 pp. 25s.]

THESE two books deal with the same problem: teenager crime and delinquency, but they do so in very different ways. While the American study is exclusively interested in the American situation and uses only American literature, Fyvel, though mainly concerned with Britain, has valuable chapters on several Continental countries and the U.S.A. as well. While Cloward and Ohlin concentrate on pure theory and offer hardly any factual material, Fyvel has studied his subject empirically, in part through first-hand observation and in part through interviewing some of those in direct contact with the problem. Comparisons with the British and Continental situation are strikingly absent in Cloward–Ohlin, as, on the other hand, there is inadequate coverage of the literature, British and foreign, in Fyvel's work. Notwithstanding such shortcomings, these two books have to be regarded as important contributions to the subject, but because of the difference in approach their respective value lies in different fields. Their results are, nevertheless, not very far apart, nor can they be called highly original. Much confirming evidence for what has already been known is offered, and various gaps in facts and theory are filled in.

Cloward-Ohlin's treatise is a well-reasoned survey of the well-known American theories on the origin and nature of the delinquent subculture, somewhat marred by a certain verbosity and too much repetition of the obvious. The title is, perhaps intentionally, ambiguous. Opportunity may be one for good or for evil, for legitimate success or for crime. It is one of the main points of the authors that social scientists and criminologists have so far been interested only in either the one or the other of these two aspects without attempting to correlate them: Merton's theory, which they accept in all essentials, deals exclusively with the discrepancy between the culturally prescribed aspirations of American society, with its professed ideology of equal opportunity, and the utterly inadequate legitimate avenues of access to these prescribed goals, in other words with the weaknesses in opportunities for good. The Chicago School of Clifford Shaw, on the other hand, concentrates on the opportunities for crime existing in delinquency areas and Sutherland's theory of differential association is concerned only with the learning processes which enable the individual to avail himself of these opportunities. Significantly, the book is dedicated to Merton and Sutherland as the principal exponents of these two different lines of thought. Cloward and Ohlin try to combine the two aspects by using the concept of differential opportunity to cover both. There is equality of opportunity neither for legitimate nor for illegitimate goals in American society; one might be tempted to say that in that society it is nearly as difficult for an individual member to become a successful criminal as to be an eminent business tycoon. Of these two streams of thought pursued in the book the line chosen by Merton clearly attracts the interest of the authors more than the other, and it is here that their principal contributions lie. One of their most important points is the apparent inevitability of the conflict beween goals and opportunities inherent in the very organisation of a democratic society. Here they have succeeded in further developing and supplementing the work of Merton and his followers. To give only one of many relevant illustrations: they try to work out a typology of goals within the lower social classes, to which most of the delinquent boys belong. What exactly is it these boys aspire to? The authors distinguish four types of aspirations and in this connection they criticise as too general Albert K. Cohen's view, in his *Delinquent Boys*, that many of these discontented boys, unsuccessfully and perhaps unconsciously, seek to adopt middle-class values and ways of life. Another attempt at further classification is the valuable analysis of the delinquent subculture and the distinction of its three types: the criminal, the conflict, and the retreatist, the first leading to property offences, the second to violence and the third to the consumption of drugs, and each representing a different style of life and different problems of social control and prevention. Throughout it has to be borne in mind that the authors aim at an explanation of the origins and characteristics of criminal gangs of adolescents and therefore use an exceptionally narrow definition of delinquency as an activity resulting from "the performance of social roles specifically provided and supported by delinquent subcultures," thereby excluding delinquent acts not essential to the performance of such roles or committed by lonely individuals, neurotic or otherwise.

In a book so rigidly sociological as the present one we can expect to find issues of individual psychology to be comparatively neglected, and actually they are here confined to one single observation, which is, however, one of great importance: the authors stress the tendency of American society to attribute success and failure to essentially individualistic factors and thereby to deflect criticism from society. Those who accept this explanation of their own lack of success are, it seems, the intrapunitives of Rosenzweig's classification, to which the authors refer only in passing, and they are the ones likely to develop a sense of guilt. On the other hand, the extrapunitives blame society and have no feelings of guilt, nor are they in need of any "neutralising" techniques, but they are the ones most likely to seek the support of others equally inclined to put the blame on society and to indulge in gang activities. While all this is convincing, it is not equally certain that, as the authors seem to believe, all members of this category can be labelled psychopaths, though some of them probably are. The criterion "absence of guilt" is not quite as infallible as the authors think. Nor does the book offer any satisfactory explanation *why* certain individuals blame society and others blame themselves, and there is no real attempt to relate the sociological to the psychological interpretation. If the authors had not confined themselves so narrowly to sociological and homegrown literature they might have found studies such as T. Grygier's *Oppression* quite illuminating in this connection.

If less space is here devoted to Fyvel's book the reason is not that we regard it as less important, which it is certainly not, but because many readers are likely to be far more familiar with the facts and sentiments presented by him than with the rather involved and abstract theoretical arguments and constructions of Cloward and Ohlin. The picture of the various phases of the Teddy boy phenomenon which Fyvel draws in great detail is true to life, and his interpretations can also be accepted. Both the facts and their explanations are highly disturbing and far from flattering to our "affluent society," and the situation differs from the American model in degree rather than in kind. The author sees these adolescents as "victims of a mechanised society" where the slow go to the wall, of a "distorted materialist society without purpose." Who can blame him for his pessimism, who can honestly tell him that his diagnosis is wrong? He leans heavily on Galbraith, as indeed every observer has to do who is willing to face the facts—which does not mean that all of Galbraith's views can be automatically applied to British society. This is true in particular of Galbraith's thesis that the concern for security has greatly declined as a consequence of affluence; in this country at least it has not, and it is not without reason that Fyvel calls his book *The Insecure Offenders.*

H. M.

REVIEWS

ESSAYS IN CRIMINAL SCIENCE. Edited by GERHARD O. W. MUELLER. [New Jersey: Fred B. Rothman & Co., South Hackensack; and London: Sweet and Maxwell, Ltd. 1961. xvi+460 pp. U.S. $10.00; U.K. £3 10s.]

THIS extremely well-produced volume has been published on behalf of the Comparative Criminal Law Project of New York University in honour of the fiftieth anniversary of the *Journal of Criminal Law, Criminology and Police Science* and of Professor Robert H. Gault as its Editor-in-Chief from 1911 to

1960, to whose outstanding work tribute was paid by the Editors of the *British Journal of Delinquency* in the issue of April 1960. The book is a symposium consisting of seventeen contributions by different authors. As its editor is a criminal lawyer especially interested in the comparative aspects of his discipline, but not particularly concerned with criminology, it is not surprising that the emphasis is mainly on the legal, at the expense of the criminological side, of "criminal science." There is no index, a regrettable omission in a volume of this size and variety of contents, and in other respects, too, the hand of the editor is not always as clearly visible as one might have wished. There are, however, brief editorial notes on each contributor, including not only the usual factual account of their careers and main publications but also the editor's subjective opinion of their scientific achievements—a practice which in the view of the present reviewer should not become universal for symposia of this kind.

Most of the legal contributions are first-rate. We can here do no more than draw attention to some of them: J. Ll. Edwards on "Diminished Responsibility"; Norval Morris on "The Defence of Insanity in Australia" (nobody who wishes to inform himself on the present state of the criminal law of mentally abnormal offenders can afford to ignore these two substantial articles); James E. Starrs on "The Regulatory Offences in Historical Perspective"; Helen Silving's very long and learned "Rule of Law in Criminal Justice"; and the editor's paper on "Causing Criminal Harm." There are also shorter essays by Jerome Hall, Glanville Williams and Morris Ploscowe. From outside the Anglo-American countries Johs. Andenaes writes on Scandinavian, Marc Ancel on French, Hans-Heinrich Jescheck on German, Shigemitsu Dando on Japanese law; and George Ginsburgs and George Mason deal with Soviet criminal law reform.

On the criminological side we have Paul W. Tappan's historical chapter on "Pre-classical Penology," trying to cope with a very large subject within the limited range of twenty pages; a brief sketch by Hans von Hentig on "Return to the Scene of the Crime"; Franco Ferracuti's able and well-documented but also very brief report to the Hague Congress of 1960 on psychological testing; and, given pride of place, Manuel Lopez-Rey's "Some Misconceptions in Contemporary Criminology." As I am, in the distinguished company of the Gluecks and Erwin Frey, the principal target of Dr. Lopez-Rey's criticisms, I am perhaps expected to say at least a few words on the subject of prediction studies, which he has primarily in mind. I can, however, find nothing new or particularly important in his strictures, and if he had done me the honour of reading what I have written on the matter since the Borstal Prediction Study of 1955 was published, for example in my Introductions to the Summary of Proceedings of the Third International Criminological Congress and to *Pioneers in Criminology*, and also in my book *Deutsche Strafrechtsreform in englischer Sicht* he might possibly have had some second thoughts. As it is, it would require a separate article to clear up the various misunderstandings in his contribution, but a few of the author's criticisms are so obviously mistaken and self-contradictory that a bare quotation might suffice: Among the chief characteristics of the misguided contemporary criminology, as represented by prediction studies, which he so vehemently attacks, is "the belief that as soon as the 'causes' of crime and delinquency are determined or pinned down, both phenomena will be solved. Accordingly, every effort is made to locate, if not all causes, at least those considered most frequent" (p. 12). But later on (p. 18) he has to admit that in the Borstal Prediction Study no causal significance whatsoever was attributed to the predictive factors employed. Or: "This way of thinking and modus operandi has led to a kind of contemporary criminology in which crime and delinquency, and therefore offenders, are not actually considered as part of a social structure or as manifestations of it, but as something apart or isolated which should be treated scientifically rather than sociologically" (p. 14). I am somewhat puzzled to learn that in the Borstal Prediction Study in which so much space was given to social factors offenders were not treated as "part of the social structure." And, while modern criminologists are blamed by the author for their search for causes, they are now, two pages later, blamed for treating offenders "as something apart." Does not the search for causes, in particular social causes, spring from the desire *not* to treat offenders as "something apart"? Surely, Dr. Lopez-Rey cannot have it both ways. Again, to him it seems to be a particularly heinous crime for prediction experts to be "interested in obtaining official recognition or acceptance of their prediction methods" (p. 16). I am not saying that it is advisable in all circumstances to seek "official recognition or acceptance" for the results of scientific research, but the construction of prediction tables remains a fruitless academic exercise if they cannot be applied to official case material. And has our author never attempted to obtain official recognition for his own scientific views? But I really must resist the temptation here to write the article which would be required to refute all such "misconceptions" on the part of the author.

To sum up: if we accept the legal bias of this symposium it has to be welcomed as a very worthy memorial to two important and memorable anniversaries.

H. M.

SEXUAL CRIME TODAY. Papers read by MAX GRÜNHUT, RUDOLF SIEVERTS and JACOB M. VAN BEMMELEN at the Institute of Criminal Law and Criminology of the University of Leiden. [The Hague: Martinus Nijhoff. 1960. 86 pp. 7·60 guilders.]

THESE papers were originally prepared for a Symposium organised by the Institute of Criminal Law and Criminology of the University of Leiden in 1956, in which the three present authors and Professor Radzinowicz took part. The substance of Professor Radzinowicz's paper has since been embodied in the Cambridge Report on Sexual Offences. Now we have the papers of the other three participants made available as Vol. IV in the Penal and Criminological Research Series published by a Dutch publisher, which form a valuable supplement to the Cambridge Report.

Dr. Grünhut writes sympathetically of the difficulties of finding the right means of penal and/or corrective treatment of sexual offenders. He points out that, contrary to popular belief, recidivism is less among sexual offenders than among other criminals, and observes that fines and probation are used with great success in this country for many different kinds of sexual offender. Herein lies a contrast with the German approach described by Prof. Sieverts. Whereas in England and Wales courts frequently resort to fines for sexual offenders, in Germany the use of fines for heterosexual offenders is insignificant; and although it is more common for homosexual offenders, it is by no means usual. All countries agree that in many cases prison is the only solution, but Dr. Grünhut praises the opportunities afforded by open prisons for the rehabilitation of sexual offenders. Yet how often are such offenders trusted in open conditions? The few who have been through Leyhill are hardly typical. Probably more use could be made of probation orders with a condition attached under section 4 of the Criminal Justice Act, 1948, that the offender attend a hospital or undergo medical treatment. "So far only a small fraction of probation orders have the requirement of mental treatment" (p. 14). But of the cases so dealt with, it would appear that at least one-third are sexual offenders. Dr. Grünhut and his associates at Oxford have done some research on these cases, and he gives a brief account of the findings.

Professor van Bemmelen's paper is a much more statistical account of data relating to sexual crime in the Netherlands. He seeks to explain the great increase in such offences in Holland in recent years, although he finds that by 1954 conditions were nearly back to normal in terms of the volume of crime generally. Professor Grassberger's suggestion that the rise is due to the increased longevity of the male population likely to commit such sexual offences is regarded as significant, linked with the rapid growth of urbanisation and industrialisation in Holland and the decay of family life noted by Drukker. Professor van Bemmelen suggests that the increased uncertainty about the meaning and purpose of life and the emancipation of women are important causes. The former adds to the volume of mentally disturbed and maladjusted persons, the latter to increased opportunities for sexual promiscuity. Another factor mentioned is the surplus of women in the large Dutch towns and cities. Professor van Bemmelen is satisfied that the dominant factor is our uncertainty about ethical and moral values, particularly those concerned with marriage and chastity. As to the remedy, "it is clear," says the author, "that an intensification of punishment will avail nothing. Fear and uncertainty are not removed by punishment." The only solution in relation to sexual crimes is a much more intensive programme of individual treatment in specialised institutions in which no other types of delinquent are present, according to Professor van Bemmelen.

Professor Sieverts gives an interesting account of the German statistics, available for the Federal Republic since 1951, which show that sexual crime has remained fairly low in Western Germany in the years 1951 to 1957, though there has been a rise in the figures for offenders under twenty-one. The increase applies mainly in the fourteen- to eighteen-year-old group, and among them particularly to convictions for indecency between males and indecent assaults, and immorality with children. Little attempt is made to explain the figures, but there is a brief account of the sentencing policy of the courts which shows a high proportion sentenced to imprisonment. It is good to know that " doubts are increasingly being voiced as to whether the method of dealing with sexual offenders employed hitherto is correct and justifiable " (p. 75).

Professor van Bemmelen in the Preface to this short volume expresses the hope that this book, together with the Cambridge Report, will contribute to a better understanding of the problems connected with sexual criminality and the treatment of offenders. It cannot be regarded as making an outstanding contribution, but it may well be regarded as a useful supplementary source of information and ideas.

J. E. H. W.

THE FRENCH PENAL CODE. The American Series of Foreign Penal Codes. Vol. 1. Editor-in-Chief GERHARD O. W. MUELLER. Introduction by M. MARC ANCEL. [London: Sweet & Maxwell, Ltd. 1960. 158 pp. 30s.]

THE KOREAN CRIMINAL CODE. The American Series of Foreign Penal Codes. Vol. 2. Editor-in-Chief GERHARD O. W. MUELLER. Introduction by PROFESSOR PAUL RYU. [London: Sweet & Maxwell, Ltd. 1960. 145 pp. 30s.]

THE NORWEGIAN PENAL CODE. The American Series of Foreign Penal Codes. Vol. 3. Editor-in-Chief GERHARD O. W. MUELLER. Introduction by PROFESSOR JOHS. ANDENAES. [London: Sweet & Maxwell, Ltd. 1961. 167 pp. 30s.]

THE GERMAN PENAL CODE. The American Series of Foreign Penal Codes. Vol. 4. Editor-in-Chief GERHARD O. W. MUELLER. Introduction by DR. HORST SCHRÖDER. [London: Sweet & Maxwell, Ltd. 1961. 177 pp. 30s.]

THESE four volumes in the new American Series of Foreign Penal Codes, under the general editorship of Professor Gerhard Mueller of New York University, represent a considerable contribution towards comparative studies in the criminal law. Each Code has been most carefully translated, and is accompanied by a valuable introduction by a distinguished legal expert from the country in question.

In a Foreword to the first volume, Professor Mueller expressed in his own inimitable style the reasons which have prompted this endeavour, and makes out a good case for more attention to the codified penal laws of Continental Europe. The codes here translated stand without textual comment or annotation, and the short introductions are not meant to supply such commentaries, so that the value of the volumes is necessarily limited. It is good to know that eventually a separate series may be published giving more treatise-like and encyclopaedic information than these volumes contain. Nevertheless, within the limits so accepted, the translations are valuable as providing a starting point for comparative discussion and research.

Although the introductions are naturally rather sketchy, they contain some most interesting observations. For example, Professor Paul Ryu's discussion of the relative merits of German and Anglo-American solutions to some of the vexed questions of the criminal law, especially on reckless killing, and diminished responsibility, mistake of fact and law, complicity and entrapment. Unfortunately he is not aware of the provisions of section 2, Homicide Act, 1957, concerning diminished responsibility, and regards the uncritical reception by the Korean Code of the Continental European concept of diminished responsibility as regrettable.

Professor Andenaes is justly proud of the Norwegian Code of 1902, which was one of the first important practical results of the reform ideas current towards the end of the nineteenth and at the beginning of the twentieth century. The fact that it has undergone extensive revision is not a sign of weakness or general discontent with this code, he says, but springs from the belief that with the passage of time even a good code must be reconsidered in the light of new experience, changes in public sentiment and development in legal thinking. Penologists will be interested to recall that Norway was one of the first countries in Europe to establish the use of the suspended sentence. Its extensive use today is, we are told, "one of the most characteristic features of Norwegian penal practice" (p. 9). In 1956 more than half of all sentences of imprisonment were suspended, and 78 per cent. of first offenders got suspended sentences. When suspended sentences were first introduced they were in the continental form, but in 1955 the alternative of suspending the imposition of imprisonment was adopted, modelled more on the Anglo-American system. Yet it appears that this form is rarely used. "The alternatives may be combined with supervision of the offender, and during the last years great efforts have been made to improve the probation service. But there is still a long way to go before the English level, which in this case serves as the nearest ideal, may be reached." Professor Andenaes doubts the reasoning which justifies the double-track system of security measures applied in addition to punishment on the grounds that public opinion demands both punishment and "measures" in the treatment of recidivist offenders, and it is good to know that these rules are under revision.

M. Marc Ancel's brilliant account of the background to the French Penal Code and its underlying philosophy is closely matched by Professor Schröder's account of the German Penal Code, its history and development.

As a footnote to this review, it may be of interest to note the development of comparative studies in criminal law and procedure in this country. In October 1960 the University of London offered a new subject for examination in the LL.M. degree, called Comparative Criminal Law and Procedure, and seminars have been held to prepare students for that subject by the reviewer and two of his colleagues. This development was prompted by the increasing pressure on the English criminal lawyer to take note of developments elsewhere, especially when reforming and revising the substantive law and reviewing procedure. Nowadays comparative studies have become a necessity.

J. E. H. W.

LES PRINCIPAUX ASPECTS DE LA POLITIQUE CRIMINELLE MODERNE. Preface by LOUIS HUGUENEY. [Paris, France: Editions Cujas. 1960. xi + 254 pp. Price not stated.]

IN MEMORY of the late Professor Henri Donnedieu de Vabres, the Department of Criminal Law and Criminology of the University of Paris published an anthology of eighteen papers written by some of France's leading criminologists, particularly in a speciality almost unknown in other West or North European countries or in the U.S., the "political crime." Only in France is it fashionable to speak of murder as "assassination" even if the murder is not of a political nature. Therefore, the present volume will find only a limited audience outside France. However, for those students of criminology who are interested in the subject of political murder (particularly in these days when explosions of time bombs are daily events in France and Algeria), this anthology would more than exhaust the subject and, on a very scholarly basis.

The volume is preceded by a bibliography of Professor de Vabres' writings, and an impressive one it is. It is divided into four parts and covers ten pages. Many of the contributors refer to his writings, although his writings do not deal exclusively with political crimes. The only contribution which I found on a different topic is by Leon Radzinowicz, entitled "Certain Aspects of Sexual Delinquency in England." The author cites various English laws, such as the Criminal Justice Act of 1948 and the old Vagrancy Act of 1824 (still in force today), the latter of which distinguishes between "indecency" and "gross indecency," and which the author feels should be revised, particularly since the interpretation of this Act is left to local law enforcement agencies.

The other papers are filled with minute details of theories and facts (or speculations, in the absence of facts) on assassination, which, to the French, is as serious as an "ordinary" killing without a "political motive" in other countries.

H. A. Illing

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CORRESPONDENCE

THE EDITORS,
The British Journal of Criminology

Sirs,

Your review of *Forgotten Men* suggests that I was only permitted to report what the Steering Committee allowed. George Mitchell, the Chairman of the Committee, has stated the position in his Foreword: ". . . He reported on his impressions and how the work was developing from time to time, but he was given a free hand. Similarly, in writing the report, while Mr. Turner readily accepted a number of points which were put to him, the report, the observations and conclusions contained in it are his." This is the truth of the matter. It is not relevant, perhaps, that I would not publish what I did not believe, nor suppress what I thought should be published.

It is interesting to me that the correspondent of *The Times Educational Supplement* in his review of *Ship without Sails*, published some years ago, suggested that that book, though a poor thing, was not mine own. He, too, was mistaken. I can only conclude that the fault is mine, and that this schizophrenic condition might well benefit from the attention of some of your readers. For this purpose I hopefully enclose my address.

Yours, etc.,

MERFYN TURNER.

24 Harberton Road,
London, N.19

Dr. Morris writes:

It was in no way suggested that Mr. Turner's latest work "is a poor thing, not his own" nor that he published what he did not believe. What is true is that rumours were circulating among persons connected with the organisations involved that certain aspects of Mr. Turner's findings needed careful presentation in order not to give offence. Your reviewer merely knew of these rumours. But is there any good reason for preserving anonymity through pseudonyms like "Domino Lodge"? What are they supposed to hide?

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The aim has been to give in each entry, the author's name, and the date of his birth and death; his academic qualifications; the title of the work; the edition; the number of volumes; the size; the place of publication; the publisher; the date of publication; the number of pages. Sometimes brief explanatory notes have been included.

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Michael John Davies, at the age of twenty, was convicted at the Old Bailey of murdering John Ernest Beckley who was stabbed during a series of running fights between groups of youths on Clapham Common in London on the night of July 2, 1953. When he was released in 1960, after serving seven years' imprisonment, Davies claimed that he was not the person who stabbed Beckley, and he declared he now knew who did. He petitioned the Home Secretary for a pardon, but was turned down in July 1961.

This is an absorbing account of a trial which has two main points of interest. First, there are doubts in the minds of many who have studied the facts, as far as they are known, as to whether there is sufficient evidence to show that Davies, of the many youths involved, was the one to use the knife. There is, therefore, the possibility that the wrong man was convicted. Secondly, there is the suggestion that two of the witnesses for the Crown were accomplices of Davies, and that their evidence should not have been accepted without corroboration. This was the principle ground of the appeal, and it was taken as far as the House of Lords.

Mr. Furneaux has made a thorough study of the important features and landmarks of this trial, and quotes extensively from the official transcripts. He has produced a fascinating and very readable study of a case which, on the question of accomplices at least, will probably become a leading authority.

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THE BRITISH JOURNAL
OF
CRIMINOLOGY

Vol. 3 October, 1962 No. 2

EDITORIAL

PROFESSOR CLINARD'S contribution to this issue is essentially a plea for the recognition of sociological inquiry as relevant both to the definition and understanding of deviant behaviour. At a time when sociologists are being accepted on the staffs of penal institutions, mental hospitals and other treatment agencies, he feels it is well to take stock of what sociology has contributed so far. The most useful theories and concepts which have emerged he believes to be the relation of deviant behaviour to social norms, the theory of subcultures and certain types of role theory.

There is no doubt that among those who actually make decisions about offenders, alcoholics, problem families, disturbed children and precarious marriages, and attempt to do something about these problems, there is a great deal of question-begging about definitions. "Anti-social," "unstable" and "unsatisfactory" are epithets seldom defined any more than the validity of such terms as "social disorganisation" and "unhappy home life" are seriously questioned. But if there is one thing that sociology has done it is to point out that deviance can only be measured against some standard of "normal" behaviour, and that norms vary not only from one society to the next but between groups in the same society, and over varying periods of time. Professor Clinard's point is that even operational definitions of such deviant behaviour as delinquency and alcoholism, arbitrary though they may be, are better than some of the vague, imprecise and value-laden terms in common use. What, for example, is really meant when an adolescent girl is legally defined as being "beyond control" or in " moral danger "? It is arguable that a child exposed to sex and violence on television is also in " moral danger "!

Although the theory of delinquent subcultures which has been so skilfully developed by Merton, Cohen, Cloward and Ohlin has usefully disabused sociologists of the idea that social disorganisation and deviant behaviour are synonymous, the theory has its limitations. It is essentially a study of *process* rather than genesis. No adequate theoretical explanation has yet been produced to show how delinquent subcultures come about, only how they persist. Nor is there much by way of explaining the preference of individuals with similar life chances for one mode of adaptation rather than any other equally accessible alternative. Professor Clinard may be pointing a way out of this theoretical impasse when he suggests greater refinement in the typologies of deviant behaviour. It is widely accepted that offenders are far from homogeneous; it may be that addicts and alcoholics are similarly more heterogeneous than commonly assumed.

Clinard maintains that " practitioners must constantly change and adapt their programme as new knowledge becomes available. They cannot have a frozen frame of reference." Yet he argues that there is little indication in the work and writings of social workers, clinical psychologists and psychiatrists that they are using or are even well informed of the work of sociologists in their own and cognate fields. His attack on psychiatry and psycho-analysis for seeking to explain behaviour in terms of familial and especially infantile experiences is not new, any more than the criticism that these theories come not from random samples in the field but from biased cohorts on the couch. But the day has passed when Sutherland could ironically remark in " The Crime of Corporations " * that " we have no reason to think that . . . U.S. Steel has an Oedipus complex, or that the Armour Company has a death wish, or that DuPonts wish to return to the womb." It is only fair to say that while psycho-analytic extremists have laid themselves open to this kind of jibe, there are not a few psychiatrists and analysts who frequently cross, perhaps unostentatiously, into the territory of sociology and consider themselves enriched by that form of foreign travel.

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* E. H. Sutherland, *The Sutherland Papers* (Ed. Cohen, *et al.*) Bloomington, Indiana, 1956.

Those who attended the Second United Nations Congress on the Prevention of Crime and the Treatment of Offenders in London in August 1960 will remember the speeches of the strong delegation which came from Israel. It was clear that exciting new developments in the field of the treatment of offenders could be expected from this source within the next few years and that already some interesting departures had been made from the previous arrangements. Judge Reifen's article on the juvenile court system in Israel goes a long way to confirm this impression, but it also shows that there is no disposition to abandon completely the legal machinery or treatment methods inherited from the Mandate, but rather to build gradually on the existing basis, making necessary improvements and innovations here and there.

These improvements are to some extent necessitated by the social structure of modern Israel, with its preponderance of newly arrived or recently immigrated families, and the sudden changes which have brought "a clash of cultures with all its inherent consequences." As Judge Reifen shrewdly observes, in such a situation settled laws and procedures attain special significance, but it is particularly important that the juvenile courts should use their opportunity to help resolve disturbed parent-child relationships and for general educational purposes. The article shows that this is exactly what they are trying to do.

But that is not all. Israel is free to innovate and has already begun to adapt the laws and procedures to enable the juvenile court to operate more effectively. The necessity for the judge to write down in the file the reasons for his decision applies to all criminal courts in Israel, including the juvenile court. Judge Reifen tells us this also includes the reasons why a particular method of treatment is chosen. He expresses the view that "this is a helpful procedure because it compels the judge to review for himself the reasons for his decisions." The establishment of the Youth Authority, which alone decides where a child ordered to be detained in an institution shall be accommodated, is an interesting development. The power to deal with a juvenile offender found guilty of murder by the same methods as for any other offence is also interesting. But perhaps most important is the development of a strong and highly professional probation service, the origins of which may be traced back to 1937. The first steps were taken in this direction by the British Colonial Office, and since the end of the Mandate the service has expanded and developed into one of the finest services in any of the new countries. Some of the changes in the probation law described by Judge Reifen may be controversial, for instance the rule about not showing the parties the probation report. But the article shows that we can be confident about the aims and ideals of those whose duty it is to administer the system of juvenile courts and institutions in Israel, and we may yet have a lot to learn from them.

The task of classification is a necessary phase in the development of a science. In chemistry it went hand in hand with experiment; in zoology and botany it was a scrupulous collecting of specimens which fell into genus and species and was the forerunner of the Darwinian theory and the fruitful and practical theories of genetics. Arguing backwards the classes established helped to place individuals and aided in their "management" and manipulation.

In the behavioural sciences which of course cover criminal behaviour and its treatment, classification becomes both increasingly difficult and important because we face the paradox arising, as Dr. John Clarke's study implies, from constitutional determinants and the effects of both internal psychical environment and external social forces. We cannot be sure whether an individual offender belongs to a constitutional class or is an "obstinate" individual whose experiences seem to negate any stereotypology. Each offender is in a sense a law unto himself and therefore has within himself the potentiality of lawlessness.

Dr. Clarke presents us with a very practical issue; for his discussion and description of basic personality types amongst juvenile offenders takes us to the heart of classification and the assigning of individuals to constitutional groups and to the reaction types at one and the same time. Indeed if we were to satisfy scrupulously scientific methodology we would require a set of permutations resting upon constitutional types, internal psychic types revealed analytically and environmentally determined types. The subdivision becomes very hazy indeed. His eight types would have a minimum of eight variants and the intra-psychic also a minimum of eight possible variants. One leaves the computing to the mathematical enthusiast. Dr. Clarke has, by implication, no doubt about this, but he points out, happily, that the views of Henderson, Schneider and Bowlby display a considerable degree of clinical convergence.

Nevertheless if we examine Clarke's eight type classes, we cannot but note that some are clinically more objective than others. Social judgments seem to colour some types, not merely because they have the capacity to do social damage, which call for legal definition and retributive penalties; others call for social corrective measures, and yet others for clinical understanding and treatment. In other words, social ethical judgments enter into some type distinctions more than into others; these judgments may be frequently as implicit as explicit.

It is therefore incumbent upon the diagnostician and the therapist in such a finally social issue as delinquency frankly to accept these moral criteria which imply the realisation that our endeavours cannot be wholly divorced from a psychology if not a metaphysic of morals.

This consideration will determine the relationship between typology and ultimate therapy in the interest of both the individual and society.

CONTRIBUTIONS OF SOCIOLOGY TO UNDERSTANDING DEVIANT BEHAVIOUR

MARSHALL B. CLINARD (*Wisconsin*) *

MANY sociologists are attempting to apply sociology to the solution of numerous problem areas. Today one finds applied sociologists doing extensive research on such deviant behaviour as criminality, juvenile delinquency, mental illness, alcoholism, suicide, marriage and family maladjustments, and racial and ethnic discrimination. An increasing number of sociologists, for example, are even on the research staffs of correctional institutions, psychiatric departments, mental hospitals, and alcoholic treatment centres in the United States. Out of this applied and other sociological research come a number of sociological theories and concepts which appear useful. These concepts include the relation of deviant behaviour to social norms, sub-cultures and social groups, class structure, role theory and self-conceptions, typological classifications and urbanism.

Social Norms

A major interest of sociologists is the definition of the norms involved and the differences in society's tolerance of various types of norm violations. All deviations from social norms are by no means always disapproved. Inventions, for example, represent violations of norms which may be strongly approved. Other violations may be tolerated, and still others may be mildly disapproved.

Deviant behaviour consists of those violations of norms which are of a sufficient degree to exceed the general tolerance limit of a society (Clinard, 1957). This means, of course, that the norms which constitute deviant behaviour are not necessarily the same in various cultures, nor are they the same in a given culture over a period of time. Homosexual behaviour, prostitution, or drunkenness do not constitute deviant behaviour in some societies today. Some Scandinavian countries, for example, have such different interpretations of sexual norms that many delinquent and criminal acts in American society would not be regarded as such there. Changed attitudes in the United States over the past fifty years toward tobacco smoking by juveniles and young adults are an indication of how deviant behaviour can be redefined in time. Formerly there was great preoccupation with smoking among younger groups, laws were passed forbidding it, and often they were strictly enforced. Smoking was thought to be related to a variety of other social problems.

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In studying deviant behaviour the sociologist is interested in having the norms involved stated fairly explicitly. On this basis, certainly, one cannot assume that there is a " non-conformist personality type," for such would depend upon the assumption that all norms were violated regardless of their nature. For that reason most sociologists are also sceptical of loose terms like " socially maladjusted," " anti-social," " emotionally disturbed," " abnormal," " mentally ill," " sexually deviant," and even an omnibus category like " delinquency." For example, an operational definition of delinquent norms appears to be more useful than the inclusion of undefined areas of behaviour. The definition of excessive drinking and alcoholism involves a deviation from the norms of drinking behaviour within a culture and dependence on alcohol in the life organisation of the individual. Such a definition includes the amount of alcohol consumed, the purpose and meaning of the drinking, the social handicap to the individual, and the degree of inability to refrain from excessive drinking. Even the norms involved in mental disorder need to be so stated that we can determine with some precision who is mentally ill and who is not, whom we are to treat and whom not to treat. Even here an operational definition may turn out to be more satisfactory than the usual vague, unprecise and value-laden definition of " mental health " (Redlich, 1957).

Sociological studies on a broad front of strongly disapproved norm violations have shown marked differences between the official visibility and the actual extent of norm violations. Social visibility varies according to the type of deviant behaviour, as well as the sex, age, or social class to which a person belongs. Some deviations, like kidnapping or murder, may become highly visible. Others, like homosexuality, pre-marital sexual relations, or drunkenness which is not public may be only slightly visible. White collar crime, *i.e.*, among higher status groups committed in connection with their occupations, has a very low social visibility. Sociological studies using broader samples have revealed extensive violations of many norms among groups which had been thought not to have many deviants. Such studies have also shown that only a small part of most deviant behaviour becomes officially recognised, and that it often may represent biased samples of delinquents, sex deviants, criminals, alcoholics or mental patients.

Sub-Cultures and Social Groups

The sociologist is particularly concerned with the effect of the culture, sub-cultures, and group relationships on deviant behaviour (see, for example, Mannheim, 1955). The term culture refers to normative standards of behaviour, and the sociologist is interested in how the conflicting norms and values of the general culture and sub-cultures are related to deviant behaviour. Society or social groups refer to the interaction and relationships among human beings, and the sociologist is interested in the effect of all types of such group relationships.

The family, while important, is only one of many groups which may be related to deviant behaviour either in terms of norms or social relationships. Among others are neighbourhoods, schools, gangs, cliques, occupations, and religious groups. Alcoholism, for example, represents far more than simply a product of anxieties or personality traits left over from early family interaction or other childhood experiences. Alcoholism implies changes in the nature of interpersonal relationships with others, in attitudes toward drinking, in social roles and in conception of self. This process may take as long as fifteen or twenty years. Some interesting sociological findings support the conclusion that the groups to which a person belongs are related to his excessive drinking, and that alcoholism may be largely a product of the difficulties arising from the excessive drinking itself (Clinard, 1957, pp. 306–307). Group drinking and cultural factors play an important part in determining who becomes an excessive drinker. In modern society there seem to be pronounced differences in excessive drinking according to the drinking habits of one's companions as shown by differences in the incidence of alcoholism by sex, social class, occupation, religious and ethnic affiliation. Jews and Italians, for example, have a low rate of alcoholism (Lolli, 1958; Snyder, 1958).

Large modern societies consist of a variety of sub-cultures and social groups, each often with its own set of norms and values not only as to what constitutes proper conduct but also even as to the goals of life itself. Sub-cultures, like cultures, tell a person what he must do, ought to do, should do, may do, and must not do (Williams, 1954, p. 23). Cohen (1955, p. 59) has suggested that sub-cultures emerge in a highly differentiated society when, in effective interaction with one another, a number of persons have similar problems. Sociological research has shown the existence of pronounced differences in normative structures of sub-cultures involving persons of different age groups, social classes, occupations, racial, religious and ethnic groups, neighbourhoods and regions. In addition, there are some even more limited sub-cultures such as those among teenage gangs, prostitutes, alcoholics, drug addicts, homosexuals, professional and organised criminals. Even institutions for the treatment of deviants, such as prisons, are actually sub-cultures with their own social systems (Clemmer, 1960; Cressey, 1961; Cloward *et al.*, 1960). In fact, so diverse are the norms of most large societies that there are probably only a few norms which are accepted as binding on all persons.

This means three things: (1) that within a modern society there may be almost as pronounced differences among various groups about the norms of accepted behaviour as there are between large cultures; (2) that to explain logically how members of certain deviant groups in a society come to act the way they do can be explained in the same way, for example, that an Eskimo learns culturally to become an Eskimo; and (3) that when we speak of the norms of a given family we are likely to be referring actually to the social class, occupational, or other sub-cultural group to which the family belongs.

Some, of course, will raise the question, and correctly so, that intimate contact with deviant sub-cultures does not affect all persons in the same manner. Sociological research has suggested that the explanation for this lies in the fact that, first, no deviant sub-culture exists as a closed system for all its members, for even in a high delinquency area they are exposed to other norms. Second, the self-conception of the individual may serve as an insulator against participation in deviant norms. Recent sociological studies of delinquency, for example, indicate that the conception of self as a " good boy " is one of the chief insulators in areas of high delinquency (Reckless *et al.*, 1957). Such a self-conception is not only acquired in the family, but also through the school and neighbourhood.

Another useful concept for explaining differential behaviour is whether group membership constitutes a reference group to the person. Membership in a group has little meaning for deviant behaviour unless the individual comes to identify with it. (For a discussion of differential response, see Clinard, 1959.)

Recognition of sub-cultures in a society seems to have further implications. Rather than seeing a society, neighbourhood, or family as " disorganised " we come to see that the issue is one of conflicting norms. The presence of gambling, the wide use of alcohol, patronage of pubs or taverns, or greater freedom in sexual relations do not necessarily mean that these conditions are naturally " bad " or " disorganised." The slum sex code may be as highly organised and normative regarding pre-marital relations in one direction as the middle-class sex code is in the other (Whyte, 1943[a], pp. 24–32).

Another criticism of the loose use of the term " disorganisation " is that actually modern society consists of competing systems of organised sub-cultures. Many sub-cultures of deviant behaviour such as delinquent gangs, homosexuality, organised crime, prostitution, and white collar crime including political corruption, may be highly organised. The norms and values of the slums are highly organised, as Whyte (1943[b]) has shown in his *Street Corner Society*. Finally, as several sociologists have suggested, it is possible that a variety of sub-cultures may contribute, through their diversity, to the unity or integration of a society rather than weaken it (Williams, 1957, pp. 1–8).

Class Structure

Modern societies are socially differentiated in many ways; probably no differentiation is greater than the variations in behaviour among the social classes based on occupation, income, residence and way of life. Studies of class structure have shown how value orientation, patterns of family life, and behaviour in general not only represent but serve actually to integrate class ways of life. So different are the social norms and other behaviour of, for example, various American social classes, that the differences in behaviour are probably actually greater than between the accepted conduct of members of the same social class but, say, from some other Western European or even Asiatic societies. Kinsey and others, for example, have shown the existence of great class differences in sex behaviour and even the nature of the sex relation itself. Studies by Green (1946, pp. 31–41), Davis (1955), and others have shown that even family-rearing patterns of the lower and middle classes are greatly different. The use of physical punishment is an acceptable form of disciplining children in lower-class families. The middle-class boy is more likely to be whipped if he fights; the lower-class boy if he does not, or if he loses. Studies have shown great differences in the norms, behaviour, and family structure of teen-age youth by social class (Hollingshead, 1949).

Much of this research has directly or indirectly contributed to the understanding of deviant behaviour. There are great differences in the incidence and nature of different types of deviant behaviour by social class. Merton (1957, pp. 131–194) has proposed a modification of Durkheim's "anomie" to explain all deviant behaviour in terms of class structure, namely, that all forms of deviant behaviour result from differentials in the access to success goals by legitimate means. The great incidence of juvenile delinquency among the lower class has been shown in many sociological studies (Morris, 1957). To Cloward and Ohlin (1960) delinquency arises from the disparity between what lower-class youths are led to want and what is actually available to them. Desiring such conventional goals as economic and educational success, they are faced with limitations on legitimate avenues of access to these goals. Being unable to revise their goals downward, they experience frustration and turn to delinquency if the norms are available to them (Cloward, 1959, pp. 164–176). Cohen (1955) has suggested that delinquent gang behaviour is a product of group solutions to the status problems, needs and frustrations of the American lower-class boy in a world of predominantly middle-class values and virtues, expressed through middle-class teachers, social workers, judges and others. Miller (1958) has gone even further with his theory that gang delinquency is a product of the subcultural norms of the lower class. Other sociological investigations have found that auto theft is more likely to be a middle-class juvenile offence (Wattenberg and Balistrieri, 1952). Many of the sex offences of juveniles appear to be related to social class (Reiss, 1960).

The rates for crime in general are higher in lower-class areas. Nearly all crimes of violence such as murder are committed by lower-class adults, and the nature of lower-class sub-culture and family life seems to offer an explanation of the origin of most murders (Bullock, 1955; Wolfgang, 1958).

Sociological studies have shown the existence of wide-scale violations of law by persons in the upper and middle classes, politicians, government officials, businessmen, labour union leaders, doctors and lawyers (Sutherland, 1949; Clinard, 1952). These findings indicate that general theories of the relation of crime to poverty, bad housing or low intelligence have little validity. Moreover, sociological research suggests that it is hard to see how psychiatric or psychoanalytic theory can explain most crime in the face of evidence of widespread violations of law among all classes and the existence generally of a low order of business, political and labour ethics in many societies.

Probably in no area has social class shown more pronounced differences than in mental disorder. Faris and Dunham (1939) showed this years ago in their Chicago study of the residences of public and private mental patients. More recently, Hollingshead, a sociologist, and Redlich, a psychiatrist (1958), have shown great differences in the relative incidence and nature of neuroses and psychoses by social class (see also Myers and Roberts, 1959). Schizophrenia was nine times more prevalent among those of the lowest social class. There were even class differences in the type of the neuroses.

The incidence of suicide is related to occupation and social class. This has been established by many studies including Sainsbury's (1955) study of London suicides.

Studies of class differences in deviant behaviour demonstrate the need for awareness by psychiatrists, clinical psychologists and social workers of class differences so that they, as middle- and upper-class persons, can share the perspective of the lower-class person. The lower-class person, for example, is more likely to regard mental disorder as a sin, or biological in origin; is more afraid to be thought mentally ill and more likely to be rejected by his family. In theory, professional persons have greater difficulty communicating with lower-class persons and lower-class persons in communicating with them (Hollingshead and Redlich, 1958; Williams, W., 1957).

In the treatment of delinquency and crime there is also need for the professional person to share the perspectives of the various social classes. This may be so difficult that in New Jersey they are now using experimentally citizen conference committees from the same class, consisting of neighbours, relatives and friends, in supervising juvenile probationers in place of, or as a supplement to, professional persons.

Role Theory and Self-Conception

Deviant behaviour, like all human behaviour, develops out of a process of social interaction and communication with other persons. The study of social roles, organised systems of behaviour expectations and attitudes, and particularly the concepts of role playing and role taking are especially important theoretical tools in the study of deviant behaviour (Lemert, 1951; Clinard, 1957; Bernard, 1957). In the course of the day the activities of a human being are the performance of a series of roles, the behaviour for which he has largely learned from the groups to which he belongs. The diversity of social roles, provided by the variety of sub-cultures and urbanism, is an important factor in the extent of certain types of social deviation in a society. Much of delinquent and criminal behaviour represents the acting out of roles. Moreover, because of the diversity of roles in modern urban society and their lack of co-ordination, the responses of persons to certain situations may often fail to conform to what is expected. A person's evaluation of his role and the evaluation of others may not always be the same. Such role conflicts become important in the analysis of mental disorder and the problems of older persons. Even minority discrimination is a problem of role conflict.

Self-conception is an important corollary in the sociological and social psychological analysis of roles. Self-conception is the image in our minds of the " self " (ourselves) that we try to enhance or defend. It is when individuals have their behaviour socially defined and identify with this definition that they take on behaviour patterns and attitudes characteristic of a definite deviant type. When deviant behaviour is consciously incorporated into the self-image this identification itself is a motive for further behaviour. Societal reaction may reinforce the deviant's self-image.

Whether of deviants or non-deviants, self-conception does not appear to be a static entity fixed as the result of family experience. It can be modified throughout life. The self-conception of a mentally ill person, alcoholic, or suicide is the product not only of the reactions of the father and mother, but of wife and husband, employer, neighbours, other relatives and friends. The self-conception of some types of deviants is the product of the sub-cultures to which they belong. The identification and label, for example, of " delinquent," " criminal," " neurotic," " psychotic," " alcoholic," or " drug addict " may later result in serious consequences on self-conception. Certainly minor deviations, such as certain acts of delinquency, may become intensified through this labelling process.

On the basis of sociological research, social workers can show that improper handling of self-attitudes, by other staff personnel, whether in courts, prisons, or mental hospitals, can make the efforts of social workers extremely difficult (Shaw, 1930; Clemmer, 1960; Stanton and Schwartz, 1954). If courts and penal institutions work in a punitive way as dispensers of justice, or if treatment centres for the mentally ill or alcoholics are simply places of custody, social workers who try to take a therapeutic view may find their work largely negated as far as self-feelings of the deviant go.

Types of Deviant Behaviour

Sociologists interested in the study of deviant behaviour have attempted to develop more precise classifications than are denoted by such omnibus categories as delinquents, criminals, the mentally ill, suicides, alcoholics or drug addicts. Typing of deviants is generally the result of the study of behaviour syndromes. Thus criminal types have been worked out on the basis of social roles, self-conception, association with criminal norms, progression in crime, and the role of personality traits. Two main types may be distinguished, individual and career, and more specifically such types as the criminal insane, extreme sex deviates, occasional criminal offenders, habitual petty offenders, white collar criminals, ordinary criminal careers, organised criminals and professional criminals (Clinard, 1955 and 1957).

Although little has been done as yet, it is also necessary to delimit various types of delinquents and patterned types of offences in which delinquents engage (Martin, 1961; Clinard and Wade, 1958). A delinquent who commits a sex offence is likely to be a very different type from most delinquents who steal autos or commit vandalism. Reiss (1952), a sociologist, using 736 psychiatric records and combining them with social correlates has, for example, classified youthful offenders into three types.

A classification in terms of behaviour systems is a far cry from psychiatric and other categories based on the nature of personality traits or personal adjustment, since the latter actually fail to distinguish the sophisticated from the unsophisticated offender, or usually the offender from the non-offender. Certainly no set of personality traits characterise all deviants or for that matter all delinquents or criminals.

Sociologists working with those from other disciplines have also been interested in classifying types of alcoholic drinkers, drug addicts, suicides and more recently types of role conflicts in mental disorders and in old age. Research on drug addiction likewise has shown the necessity for considering types of addicts. Sociological study of opiate addicts, for example, has shown a social psychologically different process from the addiction process among non-opiate users (Lindesmith, 1947). Likewise marihuana use, which is of course not addictive in the strict sense, seems to result from still another and different social psychological process (Becker, 1953). Working with psychiatrists, a classification of mental disorders in terms of types of interpersonal relations and role behaviour may eventually be developed. Suicide has been classified by sociologists into various types (Durkheim, 1951). The extensive research work by sociologists in the adjustment of older persons may enable us to classify the role and status problems of old age, particularly as they relate to mental disorders, into several types. The retired professional person, for example, certainly seems to encounter different problems from that of the worker.

The practical implications of typology of deviants for social work is great. Social workers, or in fact any practitioner, can in this way approach the deviant not with a general frame of reference applicable to all but with different therapies based on given typology. In this way the social worker, psychiatrist or clinical psychologist can work out diagnostic and treatment typologies to each one of which presumably different therapeutic procedures might be applied (Kahn, 1957). For example, there are certainly delinquents and criminals whose personality traits and personal organisation are seriously disturbed emotionally and who exhibit unique personality traits. For them therapy must deal with this type of personality organisation, presumably using psychiatric theories. Nearly all delinquents and criminals, however, appear to be normal psychologically and not " emotionally sick," and the problem basically with them is one of changing their attitudes. This requires great skill on the part of social workers and other practitioners to devise procedures and situations which will accomplish this.

Urbanism

Deviant behaviour is largely a product of social and cultural forces of the wider society. These forces include, particularly, urbanism and the values of the general culture. A recent report (Wilensky and Ledeaux, 1958, p. 13) on the relation of social welfare to the urbanised society has stated:

> The massive changes wrought by industrialisation in the Western world are now spreading at an accelerated pace to the most isolated parts of the world. . . . Urban-industrial society is the central stage for more and more of the human drama. American social work is part and product of the larger social and cultural setting in which it lives. While it helps to shape

> the larger society, social work reflects more than it determines the nature of the whole. It cannot be understood apart from its social context. And the more we understand its links to society and culture, the better we will see opportunities to influence the development of welfare services and the profession of social work.

The rapid spread of urbanism, or the " mass society," has contributed a great deal to the increase in deviant behaviour in the contemporary world (Rose, 1954). By urbanism is meant a way of life accompanied by characteristics such as individualism, rapid cultural change, emphasis on materialism, culture conflict, and, above all, a decline in intimate communication and informal social control. These characteristics have generally accompanied urbanisation, which refers to population concentration, and which, in turn, is largely but not exclusively a product of industrialisation. Urbanism is not always associated with urbanisation, however, for rural areas are increasingly displaying these characteristics. Conversely, one may have enclaves within large cities which display little of the characteristics of urbanism, and cities themselves may vary in the degree to which they have urban characteristics.

The process is transforming social relations all over the world. Two out of three Americans and four out of five persons in Great Britain now live in urban areas, some of them of immense size. In the Russell Sage Foundation volume, *Industrial Society and Social Welfare*, it was recognised that industrial-urban society is the central stage for an increasing amount of the social problems of mankind and that " These massive changes in American society are the major determinants of the social problems which create the demand for social welfare services " (Wilensky and Ledeaux, 1958, p. 17).

Urban women have become more self-sufficient, more demanding of equality, and less satisfied with traditional family roles. There is evidence that this situation has not only changed the nature of family life but also has affected our high urban divorce rates. Under conditions of urbanism the aged often have been left stranded. Many sociological studies have shown that there has been a loss of status and of satisfying roles, and that personal dissatisfactions have arisen from the conflict between the role expectations of the older persons and their role achievements. This appears to be reflected in some of the mental problems of the aged.

Most of all, urban life has fractured much of the conventional family system and has, instead, brought new groupings mainly on the basis of age, occupation and the like. Urbanism has made possible the growth of teenage subcultures which are often at variance with family, school and adult norms. This conflict, as yet, has not been as great in the middle class but appears to be on the increase. To these effects of urbanism can be traced a great deal of the explanation for contemporary delinquency among youths. Much teenage delinquency in an urban society probably represents a definition of excitement and a means of gaining status among the peer group (Lowson, 1960; Bloch and Niederhoffer, 1958).

The problem of an urban society such as ours can be illustrated by studies of the extent and effect of contemporary mobility on deviant behaviour. According to estimates based on contemporary trends, a worker in his lifetime today in America is likely to change his residence eight times and two or three of them would involve an entirely different community (Bogue, 1957). Such mobility, even within a community, often means a loss of relatives and neighbours. Children and adults are faced with new norms and social roles, as well as the reconciliation of old norms and roles with new ones. Personal reputation comes to mean less to the mobile person as the influence of personal social controls declines. Controls become more secondary, the urban family comes to be, as Reuben Hill has termed it, " the lonely family."

Mobile persons appear to encounter considerable difficulties. In a New York State study of first admissions to mental hospitals, migrants were found to have considerably higher rates than non-migrants (Malzberg and Lee, 1956). The differentials between these two groups were frequently more than 100 per cent. and sometimes as high as 200 to 300 per cent. The rates were greater for all psychoses, and for schizophrenia and the manic-depressive disorders. A recent large scale study by a sociologist of the epidemiology of mental disorders in Texas has shown a much higher rate for rural migrants to cities (Jaco, 1960).

Studies of many kinds of deviant behaviour have shown the pronounced effects of urbanisation and urbanism. Rates for delinquency and most crimes, for example, vary directly with the degree of urbanisation of the community. With few exceptions the same is true for rates of alcoholism, suicide and many other forms of deviant behaviour.

Conclusions

Sociologists are still for the most part not practitioners for nearly all sociologists are teachers and research workers. This does not mean, however, that many sociologists have not entered and are not entering areas of applied work. Sociologists, as a group, offer little competition to those in applied areas such as social work, psychiatry, or clinical psychology. Their role, today, is one of offering their research findings to those who are in a position to use them. In a rapidly expanding era of knowledge about human behaviour, practitioners must continually change and adapt their practical programme as new knowledge becomes available. They cannot have a frozen frame of reference. The wider application of sociological knowledge by social workers, psychiatrists and clinical psychologists could conceivably result in entirely new approaches to deviant behaviour. Such new approaches could be tested against conventional procedures to determine which is the more effective. One writer (Greenwood, 1955, p. 27) has distinguished between the social scientist and the practitioner as follows:

> Unlike the scientist, the practitioner does not produce knowledge by contributing to scientific theory. His success depends on how skilfully he uses what is already known . . . the typical practitioner is not a producer, but a consumer, of scientific knowledge . . . when the practitioner does contribute to scientific theory, he is really in the role of the scientist.

So far there is little indication that either the frame of reference or the findings derived from sociology or the sociological study of deviant behaviour are being used extensively by either social workers, clinical psychologists, or psychiatrists.[1] Social work and psychiatric journals have only a scattering of references to sociology; nearly all references are to psychiatric, psychoanalytic, or social work books and studies. While this statement would, of course, be much more applicable to social workers in case and group work than community organisation, one must agree with Kahn (1957, p. 220), a social worker, who has stated that " Although the social work knowledge now in use does include a good deal of borrowed psychiatry and psychological concepts (there has been) much less borrowing from sociology, social anthropology and related disciplines " (see also Miles, 1956).

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[1] Social work by no means deals entirely with the deviant behaviour. In referring to "social work," moreover, we are dealing loosely with a large group of practitioners, including case workers, group workers, and community organisation personnel. If this paper fails to distinguish between the groups, or appears to set up "straw men," it is due to space limitations.

On the other hand, most psychiatric studies upon which social work depends either indicate a woeful ignorance of sociological writing and research or choose to ignore it, for any mention of its existence is striking. With few exceptions, psychiatrists rarely test their theories using scientific methods, including representative samples and control groups, but assume the validity of a preconceived theory (see, for example, Clinard, 1957, pp. 133–136; Hakeem, 1958, pp. 79–112; Sewell, 1952, pp. 150–159; Bailey, 1956, pp. 387–406; Szasz, 1956, pp. 297–315). Even the Gluecks, who appear to be much respected by some social workers and psychiatrists, in their so-called multi-discipline research teams have apparently not had a professional sociologist on their staffs nor do they make more than passing reference in their research studies to the related and contradictory findings by sociologists. Reckless (1961, p. 257), for example, has re-examined the findings of their *Unraveling Juvenile Delinquency* in which they assume that the companionship factor is not important in delinquency. Having or not having delinquent gang companions was the ninth highest statistical association in a list of over 100 items.

In fact, most of the contemporary psychiatric and psychoanalytic literature on deviant behaviour, which is also utilised by many social workers, purports to show that the etiology of deviant behaviour can be traced in the final analysis to family interaction, particularly the effect of early family experiences. Events occurring at forty years of age, for example, may be explained by some occurrences at age four. The theory of predetermination of adult behaviour on the basis of heredity has largely disappeared; in its place is predetermination based on early family interaction. For the most part, the sociological approach to deviant behaviour, while certainly recognising the importance of the family, does not agree with this theory in even paramount or exclusive emphasis on the family or on parental models as the determinants of either deviant or non-deviant behaviour.

> Whether family predetermination is a valid theory of deviant behaviour actually has not been rigorously tested. Sociologists, because of their wider orientation and training, could contribute a great deal to the solution of this crucial theoretical issue if they were to make more studies specifically directed at the relation of extra-family experiences and social interaction in adult life to deviant behaviour. This would include additional research on the relation of peer groups, school, neighbourhoods, occupations, marriage and other extra-family areas of social interaction in relation to delinquency and crime as well as mental disorders, alcoholism, drug addiction, discrimination, and other types of deviant behaviour.
>
> The wider use of role theory in the studies of adult life may result in a demonstration that early life situations, particularly those in the family, have less importance in the etiology of deviant behaviour than is often presumed at the present time. Sutherland's classic study of *The Professional Thief* clearly demonstrated that criminal roles could be developed out of experience in later life (Clinard, 1958, pp. 416–417).

It is true, as some claim, that sociological findings may not in themselves suggest any direct practical application for psychiatric or social work, and there is often even disdain for any suggestion of practical use. The social worker or psychiatrist who deals with individuals and clients often finds it difficult to use sociological data. Sometimes it consists of undigested empiric facts with little relation from one study to another. This can be a frustrating experience for someone who may have had no previous sociological training whatsoever or, if he had, it was almost entirely limited to undergraduate courses in sociology.

Still, the use to which sociological research on deviant behaviour may be applied is primarily the problem of the practitioner and not the sociologist. The situation is no different from that of the application to medicine of the research findings of those scientists who discovered in their laboratories the existence of certain chemical processes which became the basis of the modern " miracle drugs " of medical practice.

Moreover, the fact that psychiatric or psychoanalytic findings about deviant behaviour are more frequently derived from therapy rather than from basic research and, therefore, by their very nature have more immediate application, may account for their more ready acceptance by psychiatric and social workers. Neither ease of application nor the fact that a theory was developed out of practical work are evidence of the validity of a theory.

There is evidence that the estrangement of sociology from psychiatry, clinical psychology and social work is diminishing (Pollak, 1951, p. 61). Sociologists are increasingly being drawn into areas of applied science. Their assistance in psychiatric and social work problems is being more frequently sought. Many sociologists are now associated with departments of psychiatry in America. Sociological materials are being extensively employed in some recent social work books (Stein and Cloward, 1958). In America, the Russell Sage Foundation has been particularly useful in bringing social workers and sociologists closer together. Programmes involving professional training in both social work and sociology are beginning in several American universities. It is hoped that in the future sociology, psychiatry, clinical psychology and social work may have closer associations to the mutual advantage of all.

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THE IMPLICATIONS OF LAWS AND PROCEDURES IN THE JUVENILE COURT IN ISRAEL

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Introduction

THE following statement is concerned with a description of the implications of laws and procedures in the juvenile court in Israel as they exist at present. There are several publications which deal with one or another aspect of juvenile delinquency in Israel, but neither the context nor the form as outlined herein has hitherto been described and published. However, there is no intention to deal with the philosophy—legal and social—of the juvenile court. Sufficient has been written about it, and there seems to be no basic difference of opinion in respect of conceptions and of the function of a juvenile court in any given society. Yet it is worth noting that the application of these basic conceptions varies rather widely—for instance, with regard to the age of criminal responsibility; the different legal definitions as to delinquent behaviour; the competence of the juvenile court in relation to different offences, etc.

The discrepancy in application of generally accepted ideas and conceptions may indicate a basically different approach, and also the different evaluation of points at issue, based mainly on the historical and cultural background and development of various countries, their traditions, habits and customs in relation to crime and punishment. In this respect Israel has the advantage of not yet being tied by its own legal traditions, and, while contemplating a new Criminal Code, it can easily draw on the experiences of other countries and integrate those aspects which seem worth having. In passing it should be mentioned that a number of drafts do exist which aim at bringing about an improvement in present laws in relation to the treatment of juvenile offenders and those who are in need of care and protection.

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But these drafts have still to be passed by our Knesset (Parliament of Israel) and there may be changes forthcoming. I have, therefore, found it preferable not to include them in this paper.

The juvenile court in its present form has been in existence in Israel since early 1950. We have now two juvenile court judges, who travel up and down the country, and all juvenile offenders come under their jurisdiction. The laws and procedures of the juvenile court are still those introduced by the British Mandatory Government, complemented by a few amendments. It is significant that the very first amendment in relation to juvenile offenders was made in 1950, when corporal punishment was abolished.

By way of introduction it seems appropriate to raise a few points which may help to clarify—even if only superficially—some of the points at issue.

(a) In Israel, a country of continuous flow of new immigrants from many countries with different cultural backgrounds, we witness a constant process of change in conceptions and values. These changes occur within the family unit and within society at large. Immigration to Israel has meant for many—particularly for those coming from Oriental and Near-Eastern countries—a transplantation into a competitive society, urbanised and industrialised on the pattern of the Western European world. This sudden change has tended to disrupt the ordinary way of life of individuals, of families and of whole groups. We witness a clash of cultures with all its inherent consequences. In such a setting there is special significance in laws and procedures, and in the understanding of the juvenile court in relation to misbehaviour of children.

(b) It follows, therefore, that we pay great attention to ensuring that parents should be present with their children in court. Frequently, parents complain that the new conditions, the influence of the new environment, the hitherto unknown habits and customs, all these are to blame for the delinquent behaviour of their children. Others admit their inability to take care of their children in a more appropriate way, and request the court to find a suitable solution. Others still mention the same reasons but try to protect and shelter their children. Many parents are near a breakdown because they regard it as a great shame on their family to have come to court. Some feel that they have failed, and this determines their attitude.

to the juvenile court and to the rehabilitation process of their children. In this situation it is sometimes the duty of the juvenile court to encourage parents, to comfort them and to inspire them with new will-power in their relationship to their children. We have found that the tolerance of the juvenile court, and the attention paid to each individual offender, provides many parents with an opportunity of adjusting their disturbed parent-child relationship. There can hardly be rehabilitation of juvenile offenders without involving parents in this process. This seems particularly the case with age groups up to fourteen years, but in many instances it is of great importance even in higher age groups. However, it has been our experience that for various reasons parents are not always co-operative. The mere presence of parents in the court-room is not the decisive point, but rather the extent of their own involvement in what is going on there. Special techniques have to be used to engage their co-operation. There are, of course, also parents who reject and neglect their children, and who take no real interest in their well-being. Fortunately for us, such parents are not numerous.

(c) Our procedure conforms with the theory, accepted in many places, that hearings in a juvenile court should be private and attendance permitted only to those who are immediately concerned with the case under consideration. Exceptions are bona fide newspaper representatives who, however, are strictly forbidden to publish anything likely to lead to the identification of the juvenile offender. The law provides for sanctions against a person who acts in contravention of this provision.

Because the public are not allowed to attend sessions of the juvenile court, there rests a special responsibility on the judge of the juvenile court. It is a moral obligation towards the individual concerned and society alike. We are very much alert to the potential dangers of court hearings without the public being present, and are therefore geared to safeguard elementary civil rights of minors and their parents. We regard it as obligatory that a juvenile offender must be acquitted if insufficient proof is brought forward to sustain the charge. Proof must be beyond doubt. We adhere strictly to this concept and regard it as part of our professional approach. In practice, approximately 80 per cent. of all juvenile offenders admit the charge held against them, which is taken as sufficient proof without further examinations.

(d) The juvenile court has legally invested powers to take care of minors under the age of sixteen years, who are in " Need of Care and Protection." A special section of the Juvenile Offenders Ordinance, 1937, sets out the provisions for invoking this section. It is proposed not to deal here with this section, because the focus of this paper is on juvenile offenders. A description of procedures and treatment methods related to minors in need of care and protection is planned in due course (a new law has come into force since this article was written).

I. *Laws and Procedures*

Procedures in cases in which juvenile offenders are involved are regulated mainly by three Ordinances. These are: The Criminal Code Ordinance of 1936, regulating the age of criminal responsibility; the Juvenile Offenders Ordinance of 1937, regulating procedures and treatment methods in the juvenile court; and the Probation of Offenders Ordinance of 1944, providing for implementation of probation. However, whenever necessity arises, *e.g.*, if a juvenile offender denies the charge held against him, procedure is then in accordance with existing laws and rules as applicable to adult offenders. This is particularly relevant in matters of evidence.

1. *Definition of Age*

Age of criminal responsibility is put categorically at nine years. Under this age no child can be brought to court charged with having committed an offence. In age group nine to twelve years, a child is not criminally responsible for an act or omission, unless it is proved that at the time of doing the act or making the omission he had the capacity to know that he ought not to do the act or make the omission. In practice, the prosecuting authorities hardly ever prove this point, and it is taken for granted that a child above the age of nine years has the full capacity to distinguish between right and wrong.

There are three further definitions: a " child " means a person under the age of fourteen years, a " young person " means a person above fourteen and under sixteen years, and a " juvenile adult ".

means a person who is above sixteen and under eighteen years. The latter age group applies to females only.

All these definitions involve implications which vary in each category. The following examples may illustrate their practical application.

(a) A large number of new immigrants from Oriental countries have no birth certificates, and therefore exact date of birth is sometimes difficult to ascertain. If, for example, a child is brought to the juvenile court during 1959, and on the charge sheet no exact date of birth is mentioned, save for the year of birth which is put as 1950, then it is assumed that he may have been born on the last day of this particular year. It follows, therefore, that at the time of committing the offence, he may have been less than nine years. In such a case the child would benefit from the doubt, and the juvenile court would dismiss the case because the child cannot be held criminally responsible.

(b) If in age group nine to twelve years no proof of full mental capacity has been made to the satisfaction of the court, there is a good chance of winning on this ground in the Court of Appeal. However, only very seldom is a case brought to such a court on this ground.

(c) If the juvenile court orders that a fine, damages or costs be awarded, and the offender is a "child" (under fourteen years) payment shall be made by the parent or guardian of the child. Any sums imposed and ordered to be paid by a parent or guardian may be recovered from him in like manner as if the order had been made on the conviction of the parent or guardian. Parents can, therefore, be held responsible for the misbehaviour of their children. However, the juvenile court has to be satisfied first that there was negligence on their part.

(d) In the case of a "juvenile adult" (female only), when the juvenile court is satisfied that she has committed an offence, because of the age factor methods of treatment are more limited than in the other two categories. There is no dismissal of the charge, there is no discharge on entering a recognisance, and there is no placing under the care of a relative or other fit person, etc. To all intents and purposes, a "juvenile adult," though being tried before the juvenile court, is in fact regarded as an adult. Treatment methods are those used with adults. In addition, however, the offender may be sent to a reformatory school.

2. *Bail and Custody*

Where a person who is apparently under the age of eighteen years is apprehended being suspect of having committed an offence, his case is investigated by a police officer. After taking down the necessary details, the police officer is under obligation to release such person on a recognisance—with or without sureties—which secures his attendance in court. There are a few exceptions to this rule, *e.g.*, if the charge is a grave crime such as homicide, or if it is in the interest of the person to remove him from association with undesirable people, or if there is reason to believe that the release would defeat the ends of justice. It is noteworthy that about 95 per cent. of all juvenile offenders are released on bail, pending their court appearance. It has been our experience that parents or other close relatives are in the majority of cases agreeable to vouch for the apprehended juvenile offender, though possibly with misgivings.

Whenever it is necessary to put a juvenile offender into custody, there are several possibilities, all of which provide that the juvenile offender should not be in contact with adult offenders.

1. There is the police lock-up, which is generally used for brief detention up to two days only, in cases in which the investigation is not yet completed.

2. A detention home, run by the Ministry of Welfare, provides for detention on court order. This place is for the rather unruly type of juvenile offender. However, it provides also for observation, and for psychological and psychiatric examinations to be made. In fact, because the youngsters in this place are unruly, most of them undergo these examinations. It is a closed institution.

3. An additional place is a remand home, also run by the Ministry of Welfare. The main function of this place is in the field of classification and observation. Naturally, the inmates are also subjected to close psychological and, if necessary, psychiatric observation and examination.

However, it should be pointed out that it is our definite policy to refrain from detaining a juvenile offender even for brief periods. We believe that even a short period of detention can have negative repercussions. This would be the case if detention were ordered prior to hearing the case in court, or by court order to obtain a specialist report. We have therefore developed facilities for ambulant treatment of those juvenile offenders who are in need of psychological or psychiatric examination. We thus avoid the emotional upheavals involved in detention and also unwarranted association with real delinquents in these places.

3. *Summary jurisdiction*

The juvenile court in Israel is a court of summary jurisdiction. Its jurisdiction is over children and juveniles in the above-mentioned age groups for any offence punishable with not more than five years' imprisonment. Thus, it is the duty of the juvenile court to dispose of these cases without having discretion to refer them to a court of higher instance or for adult offenders.

However, it is the duty of the court in all cases in which a juvenile offender is charged with an offence punishable with more than five years' imprisonment, to ask him if he prefers to be tried by the juvenile court or by a court of higher instance. Moreover, the court is obliged to explain to the juvenile offender and also to his parent or guardian the meaning of being tried by the juvenile court or by a court of higher instance.

The wording of this proviso leaves no doubt as to its intention, namely, to enable the juvenile offender to use his discretion and to prefer to be tried by the juvenile court. As yet, it has never occurred that a case was referred to a higher instance. That is to say, all offences, including murder, can be tried summarily by the juvenile court, and are in fact so tried. It is our opinion that if the juvenile court is the appropriate place to deal with juveniles who have committed minor offences, it is even more so the appropriate place to deal with juveniles who have committed serious offences. These latter may be even more in need of the approach accorded to them in the juvenile court.

4. *Defending Counsel*

There is a provision in the Juvenile Offenders' Ordinance which states that no advocate shall be allowed to attend in a juvenile court, except by leave of the court in any particular case in which the court considers it desirable. Our procedure is that a defending counsel, wishing to represent a juvenile offender, lodges an application to the juvenile court, asking for permission to appear on behalf of the juvenile offender. As a matter of practice, such permission has as yet never been refused.

However, it seems worth mentioning at least one reflection in this context. In Israel, we try to make use of interviewing techniques in the juvenile court in order to involve the juvenile offender in what is going on in the courtroom. The object is to establish a relationship between the court and the offender, and if possible his parents as well. It is a feature of special importance in the juvenile court. Now, if a defending counsel is in charge of the case, the juvenile offender can conveniently sit back, as it were, and adopt the position of a spectator. It enables him to remove himself from the reality situation in contrast with our endeavours to involve him. As a result, it may have direct repercussions on the effectiveness of treatment methods used by the juvenile court.

5. *Establishment of Facts*

In our judicial system the onus to prove guilt rests on the prosecution. This is regarded as elementary for juvenile offenders as well, and is irrespective of their social needs. These can be taken care of by the court only if a finding of guilt is made first.

As has already been mentioned, approximately 80 per cent. of all juvenile offenders coming before the court admit the charge held against them. Our procedure is that we ask the juvenile offender the reason for his coming to court, and let him tell us his story. If this story corroborates the facts as known to the police, we are satisfied that the particular offence has been committed by him. On the other hand, if it transpires from the story told that there is some doubt as to his guilt, we always prefer to hear evidence. This applies of course also to cases in which there is outright denial. In these instances it is the duty of the court to help the juvenile offender by putting to the witnesses such questions as appear to be necessary. Often, children and their parents do not know the procedure, they might be timid in the atmosphere of a courtroom, or they might even be insufficiently acquainted with the language. The judge is therefore expected to take an active part on their behalf, which is in the interests of justice.

In this connection an additional feature has to be pointed out, which has particular significance in Israel. We are confronted with the problem of a heterogeneous society, in which more than half of the population are new immigrants. A large proportion of them originate from countries where a democratic way of life is practically unknown. In the new environment many frustrating situations arise, and many parents show an increasing amount of resentment if their children are brought to court. This resentment finds its expression in hostility towards the court as the representative of the new society. It is convenient for them to air these feelings if their children deny the charges held against them.

Apart from the judicial aspects there are also educational and psychological aspects involved. A juvenile offender, confronted with the powerful machinery of the state, may feel discouraged right from the start. It may therefore become very meaningful for him to discover that the court is not prejudiced against him and in fact takes pains to find out the real facts and even to assist him in his defence. Even if the charge is eventually proved, children and parents alike are more prepared to accept it. This acceptance, in circumstances prevailing in Israel, is a more healthy one because the facts are not imposed from the beginning. It can bring about a re-orientation in thinking and feeling, and in this respect the juvenile court can make a unique contribution towards education in good citizenship.

6. *Responsibilities of parents*

The existing law makes a distinction between responsibilities of parents or guardians if children or young persons are involved, *i.e.*, age groups nine to sixteen years, or if juvenile adults are concerned, *i.e.*, girls aged sixteen to eighteen years. With the former group not only may the court require the attendance of parents or guardians, but may also make appropriate orders to ensure such attendance.

A parent or guardian may be ordered by the juvenile court to give security for the good behaviour of his child if he is under sixteen years. Moreover, if the juvenile court is of the opinion that the case would be best met by the imposition of a fine, damages or costs, it can order such payments to be made by the parents. These payments cannot be levied against a child under fourteen years but only against his parent or guardian. However, no order of payment on behalf of parents or guardians can be made unless opportunity was given to them to be heard by the court.

An amendment, enacted in August 1958, goes one step further. In case a juvenile offender is placed in an educational institution, an approved school for juvenile offenders or any other place fulfilling this function, his parent may be ordered to contribute to his maintenance. Here, too, parents must be given opportunity to be heard on this issue, and the court must be satisfied that the parent has the financial means to make such a contribution. This amendment was introduced for educational reasons only. Many a parent has to be reminded that his child is being taken care of by the community, and he should make his contribution for his child just as others do. Again, these monthly payments provide the appropriate authorities with an opportunity to keep in touch with those parents who tend to " forget " their children once they are placed out. Payments are not ordered for the sake of income, or for punitive reasons, but rather as a means to foster and improve parent-child relationships.

II. *Methods of Treatment*

A most important feature in our court system is that judges have to write down in any given file the reasons for their judgment and also for their verdict. This also applies to the juvenile court. Furthermore, the judge must also put on record the reasons why he has chosen a particular method of treatment in disposing of the case. This is a helpful procedure because it compels the judge to review for himself the reasons for his decisions.

The most frequent methods of treatment used in the juvenile court in Israel are elaborated below. The figures are meant to illustrate only the approximate frequency of any method applied, and therefore the average over a period of eight years (1951–58) is recorded. A comparison for each year revealed that the average during this period was approximately the same for each year. An exception could be seen only in relation to placing out of children, in which a higher figure was recorded during the last few years.

The reason for this may be that there are now more places available that meet actual needs than in previous years. It should also be mentioned that the figures apply only to the measure used at the first appearance of the juvenile offender in the juvenile court.

1. *Dismissal of Charge*

It is left to the discretion of the juvenile court to dismiss the charge after the juvenile offender has been found guilty. It is a sort of admonition, and is particularly effective with first offenders who are under fourteen years. This method has been used with good results with those who have committed a minor offence, since their mere appearance in court has a deterrent effect on them, but it can by law be used for severe offences as well. During the period under review, 22 per cent. of all cases—on the average—were dealt with by this method. It cannot be used for the sixteen to eighteen age group.

2. *Recognisance*

This method is in fact also a discharge of the juvenile offender, but he has to enter a bond of recognisance as to his good behaviour. For many offenders just this undertaking, signing a form with a stamp on it, may have special significance. Furthermore, we make a point of having the parent or guardian sign on the same recognisance. Thus it may become meaningful to both of them. About 30 per cent. of all cases were dealt with by this method.

An investigation has shown that the number of recidivists in these two categories was no higher than when other methods were used. It seems therefore expedient to continue with these methods of treatment, which virtually amount to a discharge, and which we used in more than 50 per cent. of all cases.

As regards age group sixteen to eighteen years, this method can only be used in conjunction with another one, for instance a fine.

3. *Fines*

By and large, this method is appropriate in a small number of cases only. Often it is rather tempting to impose a fine, but the rehabilitative value of doing so with juvenile offenders has not as yet been established. In those instances in which we make use of this method the juvenile offender is usually a wage-earner, and the fine imposed is paid directly by him. It is only very seldom that we accept a request to pay the fine in instalments, because this would in many cases defeat the measure and its effectiveness. We prefer to have a smaller fine, but it should be paid immediately. It is indicative that we have used this method only in 8 per cent. of all cases.

4. *Educational Institutions*

Any juvenile court cherishes the belief that in many instances the best possible solution for a juvenile offender is his placement in an educational institution. This includes all the various types of institutions for juvenile offenders—the common denominator being the removal from their own home. According to our Juvenile Offenders Ordinance, a juvenile offender can be sent to an establishment appointed for this purpose for a period of not less than one year, provided that no offender shall remain there after he has attained the age of twenty years. In fact, however, almost without exception, placement orders are usually made for a period of two to three years. Approximately 12 per cent. of all juvenile offenders during the period mentioned have been sent to such institutions. All our educational institutions for juvenile offenders are a sort of open camp, and the régime prevalent there is permissive to a considerable degree. It has been our experience that a large number of juvenile offenders have responded favourably to this approach, which is demanding but not punitive. The fostering and supporting conditions in which they now live enable many juvenile offenders to get a different outlook on themselves and society at large.

An innovation was put into force in April 1955, when Rules were published according to which a Youth Authority has been established within the Ministry of Welfare. The duty of this authority is to select and direct the juvenile offenders' placements, suitable for their special needs. The juvenile court orders the period of detention, but placement is done by this authority. It is also the duty of the Youth Authority to establish new homes, to improve, supervise and direct the educational establishments already existing, to look after training of the personnel, and to ensure the rehabilitation of these juvenile offenders. This also includes the classification centre to which many juvenile offenders are directed for psychological and psychiatric examinations. A permanent committee of experts and public figures helps the Youth Authority in fulfilling its function.

Another important new venture came into force in February 1957, when the existing Juvenile Offenders Ordinance was amended by the addition of a special law dealing with the release on licence of juvenile offenders who were sent to educational establishments. A committee of five persons was appointed to consider applications for early release. These applications can be submitted by the offender or his parent, as well as by the headmaster or foster parent with whom the juvenile resides. Such an application cannot be turned down unless the applicant, the offender or his parent has been given opportunity to put the case before the committee. However, an application can be lodged only after one year of placement has elapsed, save for exceptional cases, for which reasons must be given. Those released on licence can be put on after-care up to a period of three years.

5. *Youth Prison and Suspended Sentence*

The law lays down absolute restrictions as regards a prison sentence. There is a proviso saying that no " child "—*i.e.*, under fourteen years—shall be sentenced to prison. From another provision it is clear, however, that in fact this proviso applies to a " young person " as well (fourteen to sixteen years). It says that " no young person shall be sentenced to imprisonment if he can suitably be dealt with in any other way," etc. This implies that, before sending a " young person " to imprisonment, other methods of treatment should first be tried. On the average, 0·5 per cent. of all juvenile offenders were sent to prison. In cases where the court decides on this method, imprisonment for young persons and juvenile adults (sixteen to eighteen years) should be such as to avoid association with adult prisoners. We have therefore a special Youth Prison, in which conditions are adapted to the special needs of juveniles.

The law which provides for suspended sentence came into force in 1954, and it is also applicable to juvenile offenders, provided the above-mentioned conditions are observed. In other words, a conditioned sentence can never be made against a child under fourteen years. Generally speaking, we hesitate to make use of this method in the juvenile court. It seems to us rather doubtful whether young people have sufficient maturity to realise the real implication of a suspended sentence. Moreover, in many instances, a suspended sentence is heavier than the usual prison sentence. It is an interesting feature in the field of sentencing policy. We have made use of suspended sentence in 0·3 per cent. of all cases.

In this connection an interesting law should be mentioned which was enacted in February 1957. It is an amendment to the Juvenile Offenders Ordinance, dealing with cases in which there is a conviction of murder, manslaughter or of wounding with intent to do grievous bodily harm. According to this amendment, if a juvenile offender, including a juvenile adult, has been found guilty in the juvenile court on a charge for which there is a life sentence, his case can be disposed of by the same treatment methods as for any other offence. That is to say, the gravity of an offence does not, by law, involve a grave sentence; it is legally possible to dismiss the charge of a juvenile offender found guilty of murder. It is a rather hypothetical proposition, because no such case has as yet occurred.

6. *Probation*

Probation was introduced in this country for the first time in 1922. Then, supervision of probationers was done on a voluntary basis by people appointed for this purpose. Full-time probation officers, with the sole purpose of supervising and assisting the rehabilitation of juvenile offenders, were appointed in 1937 with the introduction of the Juvenile Offenders Ordinance. A further development occurred in 1944, when the Probation of Offenders Ordinance came into force, related to juvenile as well as to adult offenders. These Ordinances, with the amendments which will now be discussed, are still in force.

In relation to probation we regard two fundamental aspects as of paramount importance. First, there is the provision mentioned in the Juvenile Offenders Ordinance that the juvenile court should obtain information as to the general conduct, home surroundings, school record and medical history of the particular juvenile offender, so as to enable the court to deal with the case in the best interests of the offender. In Israel, this information is gathered by especially appointed probation officers, who are trained and qualified in the field of social work and child care. We regard this special training as essential, particularly as one of the functions of the probation officers is to guide the juvenile court prior to disposal of the case. This information is expected to be given in each case, irrespective of the type of the offence, save for contraventions. It is an interesting feature to record that the offence is sometimes of rather a petty type, but on investigation the juvenile offender turns out to be in need of care and attention. We are therefore very much " offender minded " and not, as it were, " offence minded."

Secondly, the probation officer can make a unique contribution by guiding and assisting the juvenile offender during the period of probation. An order of probation can be made for a period of not less than one year, and not more than three years. Though it is legally possible to attach certain conditions to a probation order, the juvenile court refrains in most instances from doing so, so as not to hamper the work of the probation officer. It has been our experience that at the time of disposal of the case in the juvenile court, the dynamics of the probation period cannot be foreseen. We prefer therefore to leave the initiative for special conditions to be included, if desirable at all, to the probation officer.

Probation has been rather widely used, with 22 per cent. of juvenile offenders. From the point of view of treatment the following are the salient features in probation: a probation order can be made without proceeding to a conviction; a probationer who fails to comply with a probation order can be brought back to court for further consideration of his case; the probation order can be terminated before the initially prescribed period, if it seems expedient. It should be added that, if a probationer is brought back on breach of probation, the order is not necessarily revoked. It has been our experience in a number of instances that only after a juvenile offender was returned back to court on breach of probation, was he able to realise the meaning of being put on probation, and only then could he change his behaviour accordingly. In other words, the juvenile court is being activated in a treatment process. aiming to make the probation order workable.

In December 1953, important amendments to the Probation of Offenders Ordinance were enacted by special law.

(a) Probation, which was listed in the Criminal Code Ordinance of 1936 as one of the different kinds of punishments at the disposal of the court, was deleted as such from this Code. Thus a probation order can no longer be regarded as a means of punishment. For an appropriate appreciation of probation as a means of treatment, this innovation is very relevant.

(b) Another amendment was concerned with the practical application of supervision. The Probation of Offenders Ordinance provided that females, placed under supervision of a probation officer, shall be supervised by a woman probation officer. In our experience, this was not always found to be expedient. Often it seemed important, for reasons of treatment, that a man probation officer should be in charge of the case and do the actual supervision. Such a decision may depend on the personality of a particular girl, on her background and upbringing. We take great pains to ensure that the work of the probation officer should not be hampered by legal provisions, which might imperil the very method of treatment applied. We have therefore eliminated the aforementioned stipulation, and probationers are not dealt with by probation officers according to their sex, but rather according to their personality and actual needs.

(c) A most relevant and meaningful innovation was brought about by the amendment according to which a probation order can be made only after a report by a probation officer has first been submitted to the court. This seems to us to be most essential. Obviously, if we regard probation as a means of treatment, there must be some selection of cases. Now, if there is no report by a probation officer, the yardstick for selection remains the type of offence, or the impression the offender makes on the court, or the fact of it being a first offence or not, or the age of the offender, or the combination of some or all of these factors together. However, these can by no means be sufficient to guide the court in making a decision on probation. It seems preferable that an appropriate examination be made of material gathered by a qualified person. The chance of error is considerably lessened, which is in the interest of all concerned. Naturally, the report by the probation officer or suggestions contained therein are not binding on the court. It is our opinion that, since this new law has come into force, results of probation are better.

(d) Still another amendment was introduced in February 1958, when Rules were issued in relation to the publicity of the probation officer's report. According to these Rules it remains at the discretion of the court whether or not the report submitted to court by the probation officer should be shown to the parties concerned. That is to say, the report can be submitted to the court only. It is an exclusive document for the guidance of the court, and the parties involved may be shown the report only by special permission of the court. These Rules clarified a difficult point. It is now recognised that the report is no document of evidence, and is therefore not available to the parties.

DELINQUENT PERSONALITIES *

JOHN CLARKE (*Nottingham*) †

THE psychiatrist who is called upon to examine the delinquent child has to decide whether the delinquent behaviour is part of a morbid psychiatric illness, the reaction of a normal personality to severe stress, or one of the manifestations of an abnormal personality. In most cases it is easy to make this decision and, if one discounts the small number of obviously ill, one is left with the inevitable problem of assessing the basic personality. Certainly from the point of view of juvenile delinquency it is always important to look further than the external environment, for the " internal " environment can be very different even for children of the same family.

This paper is the outcome of a study of 500 boys who have passed through a Nottinghamshire remand home in the last four years. There is the usual element of recidivism and the usual sprinkling of serious first offences, so often found in boys who have been referred to a remand home. The conclusions are based entirely on clinical observation and the article makes no pretence at being a scientific document. It merely reflects the thoughts of a psychiatrist engaged on presenting reports to the courts.

The very number of tests available for assessing personality makes it certain that no single satisfactory method is yet to hand. The Gluecks (1950) make much of projective tests in assessing personality, particularly the Rorschach Test. Yet they are no more than standardised interview-situations. Like the latter, they depend on the skill of the examiner which is difficult to judge. Consequently, the

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* Anyone who is familiar with Kurt Schneider's brilliantly intuitive clinical studies of the psychopathic personality will see that I have drawn deeply on his work. This is because I have been profoundly influenced by his approach to clinical psychiatry. It is a great pity that his works are not better known in this country.

I am indebted also to Professor E. W. Anderson, of Manchester University, who first suggested to me that delinquent personalities might be interpreted in the light of Schneider's concept of the psychopathic personality.

I am also indebted to my senior colleague, Dr. W. W. Roberts, for his constant advice and encouragement and help in supplying me with clinical material.

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validity of this type of test has not yet been firmly established. They have certainly not cleared the way ahead to the understanding of personality.

Bowlby (1947) mentions a need for classification of delinquents and a detailed study of each type, without which statistics are meaningless. He states that forty-two of his forty-four juvenile thieves had abnormal characters and the remaining two were hardly very stable. He gives a useful typology and describes his depressives, circulars, hyperthymes, affectionless characters and schizoids. However, an adequate classification of character and neurotic disorders in children has yet to be constructed.

Notions of types of personality stem from vivid descriptions of stereotypes, with the objection that different personality traits are grouped together whilst others are ignored if they do not fit. Certain qualities and traits of human beings can be isolated or emphasised, but these cannot be compared with symptoms of illness. Classifications of this sort are rarely mutually exclusive. However, the practising doctor is not deeply concerned with such arguments. By virtue of his training in medicine, he is used to classifications. Systems and types, in spite of their drawbacks, appeal and are widely used.

I have been impressed with the views on abnormal personality put forward by Professor Kurt Schneider (1958) and feel that his descriptive types could be applied to juvenile delinquents. It is interesting to see how close Bowlby's tentative classification comes to Schneider's; indeed, several categories are almost identical. The following views are not very well known in this country but, as Professor Anderson (1959) says, there can be little doubt that they match the realities of everyday clinical practice.

Abnormal personality is defined as a variation upon an accepted, yet broadly conceived, range of average personality. This variation may be expressed as an excess or deficiency of certain personal qualities. Abnormal personalities are common in life. Two categories are easily recognised—those who because of personality anomaly suffer themselves, and those who cause others to suffer. These two types of abnormal personality are grouped together and are called psychopathic personalities. This is a clinical definition and carries no moral stigma.

Unfortunately, the term psychopath is now very loosely used. If not actually used as a collective term for all the rascals, misfits and vagrants who defy psychiatric diagnosis, then the social effects are most strongly emphasised. Even Henderson (1955) advocates grouping into (1) predominantly aggressive, (2) predominantly inadequate and (3) predominantly creative, which are basically social concepts. Again, the Mental Health Act, 1959, in the sections which deal with the psychopath, places great emphasis on " abnormally aggressive " or " seriously irresponsible " social conduct.

However, Schneider's concept of psychopathy is based mainly on the inborn constitution. He stresses largely innate tendencies but does not deny the importance of exogenous factors. He feels that the constitution of a person unfolds in his life experiences. The latter are perceived and either incorporated or acted upon according to the significance they have for the personality. The term " neurotic " is abandoned. Such disturbances, he alleges, always arise from a constitutionally determined abnormal personality. It is interesting to note that Slater's (1953) studies on psychopathic and neurotic twins support this, in that neurotic symptoms were found to represent an exaggeration of traits evident at other times and the personality make-up seemed to play a greater part than the actual stress in deciding the form of symptoms.

Ten types of psychopathic personality are described, but Schneider remarks on the difficulty of placing individuals in his categories, on account of the blending of characteristics. This difficulty was not so evident in dealing with delinquents. This may be due to the more noticeable effect of the constitutional element having free rein in an immature personality as yet unhampered by many life experiences.

It is now proposed to discuss the personalities of delinquent boys in the light of Schneider's concept, with some additional comments.

Hyperthymic Personalities

These boys usually have a natural good humour and a sanguine temperament. They are often energetic, restless and love sports and outdoor activities, but the emphasis is on the basic optimistic mood. Frequently, it is their blithe over-confidence which carries them far beyond their intentions. Painful warnings are soon forgotten and much behaviour is random and uninhibited. Delinquent acts often occur on the spur of the moment. Many of these boys are like one who was described as " a spasmodic worker, domineering, a good mixer, very plausible, who shows a complete lack of foresight and planning "; or another, " a completely disruptive and restless influence in the class."

The " real live-wires " are a nuisance in the neighbourhood and are readily recognised as such by the police. They are intrepid and often embark on dangerous adventures such as climbing over factory roofs to gain access to premises through impossibly situated skylights; one ten-year-old regularly jumped a six-foot gap from his bedroom before sliding down the twenty-foot drainpipe en route to nocturnal adventures. The police stated that this feat would have daunted many an adult.

Some hyperthymes are real " good sorts " and are liked by all. One such popular boy leaped forward with yelps of joy when his father called to see him at the remand home. There was much hearty back-slapping and raucous laughter during the happy reunion. Amongst the less popular hyperthymes are the loud boastful liars oozing with self-confidence and the contentious ones who, although active, are quarrelsome and often very spiteful. As one headmaster said, " He is most confident and forthcoming, an unpleasant ringleader and very argumentative." Some are very vulnerable and sensitive to slights. They soon become unruly and difficult to handle. One such boy became thus disturbed following the death of his father and brother and developed rudimentary paranoid ideas.

I found 57 (11 per cent.) boys who were undoubted hyperthymes. Of these six were particularly contentious and spiteful. Nine boys had intelligence quotients of less than 70 and four of these had been ascertained as educationally subnormal. The great difficulty with these is that the hyperthymia is readily mistaken for genuine mental alertness and they are pushed through normal schools, where they soon become problem children. About half of this whole group were poorly endowed intellectually, yet the clinician is often impressed by the fact that it is not so much the dull intellect that makes them feckless, but rather the vigorous drive and optimistic expectations. These children just seem unable to keep out of trouble. They are ready for anything. In fact, well over half (thirty-one) had been in serious trouble well before puberty. The youngest was eight—" a charming boy, entirely plausible, with absolutely no sense of right or wrong."

The outstanding trait possessed by many hyperthymes is aggression. In some cases aggression appeared following the death of a father and one suspects that a strong drive was being frustrated. However, in most cases the aggression was put down to being just part of an expansive, domineering personality. Only eighteen boys were considered to be real misfits at school and most of these played truant. The reasons for truanting are probably bound up with ebullient spirits, a need to dissipate energy and the quest for adventure.

Regarding separation of any kind from the parents, only twelve hyperthymes had suffered prolonged separation from the mother in Bowlby's (1953) sense, as opposed to twenty-five hyperthymes who had similarly been separated from fathers only. If this difference is considered with the very frequent references to " inadequate mothers " and " indulgent grandmothers " amongst hyperthymes, one has a glimmer of insight into the reason why some of these boys become delinquent. It seems as if the constitutional high-spiritedness and optimism are allowed to unfold and have free rein, because of the lack or inadequacy of parental discipline. None of the boys seemed to have had facilities or encouragement for social outlets for excess zeal and vigour.

Depressive Personalities

It is not so easy to recognise the depressives who so constantly feature a gloomy pessimism. These boys are deeply distrustful and have a persistent sense of emptiness; they fail to find satisfaction because of their poor internal resources. All these facets of personality pave the way to delinquency.

Of the fourteen depressives examined, only one had a kindly, gentle, sensitive manner with his persistent sadness. All others were ill-tempered with sour, brooding dispositions. Most were cold and selfish whilst some were really chilly and suspicious. " He is irritable—a lone wolf—morose, surly, a bad influence at school. He does not waken up until noon," said one headmaster.

Some depressives have mild paranoid feelings. " He is sullen, off-hand and has a chip on his shoulder " or " he is moody, withdrawn, aloof, antisocial and irritable "—these were typical comments from probation officers. One boy of fourteen was " surly and sadistic," whilst another at fifteen was said to be " fatalistic, pessimistic, a poor mixer with an uncontrollable temper." It is interesting to note that, with one exception, all the depressives were adolescents, although one individual was said to have become sullen at the age of eleven.

There can be little doubt that depressives suffer a great deal from unhappy experiences and crises. This was particularly seen in the case of a teenager who changed to a comprehensive school. He soon felt " at sea " in his lessons, anxious and cut off. He rapidly became surly, unpleasant and a bully at school. He drifted into a delinquent gang to seek new pleasure and comforts. At first his thefts were in the nature of " dares," but his admission to the home was precipitated by a vicious gang assault on an elderly vicar. His appearance was sour and unpleasant and the only spark of humour was seen when he described with malicious glee how they had tied up a boy in a sack and kicked him around just for a thrill.

As many as ten boys were remarkable for their aggressive behaviour and five of these were regarded as particularly vicious and severely aggressive. It is worth noting that the younger depressives were not generally aggressive, as the older ones were, whilst the late teenagers were invariably so to a marked degree. It seems that as the depressive personality emerges in adolescence, irritability increases probably with an element of explosiveness. These boys must obviously be earmarked as potentially dangerous individuals.

All but three were serious misfits at school, and, from headmasters' reports, it seemed clear that normal healthy children gave these very unpleasant boys a wide berth, which probably deepened their conflicts further and increased their social isolation. In spite of this only three played truant. Perhaps their dogged persistence has some relationship with their dogged pessimism.

Insecure Personalities

There are two main types, the sensitive and the anankast, both of which feature a marked inner insecurity. These are boys who are very impressionable and yet have difficulty in giving active expression to their deeper feelings and emotions. They are forever uncertain and there is an internal working over of every experience. An eight-year-old was " negative and colourless, very self-contained, with very little capacity for forming friendships." A headmaster said of a teenager: " He is superficially pleasant and good, but we have not managed to reach his innermost soul and conscience." Worthy character traits are often stressed like this. A thirteen-year-old possessing many worthy traits, feeling ashamed and guilty after his first delinquent act, underwent a religious conversion. This seemed to expiate his guilt and he appeared much comforted. Remarks such as " He is severely handicapped in his relationships with adults," or, more learnedly, " His basic insecurity automatically leads him to put up defences which prevent a very close relationship being formed," often appear in reports concerning the insecure delinquent.

Conflicts over sexuality are common, occasionally with a marked paranoid colouring. The latter seems to have its basis in sibling jealousy. Of the twenty-three boys found to have insecure personalities, nine had conflicts of this sort. A fourteen-year-old had been charged with indecent exposure. He had always been sensitive and conscientious. His invalid father, in and out of hospital for years, had recently died. This was followed by severe brooding and the onset of indecent exposure. These acts were thought to be in the nature of compulsive urges connected with his emerging sexuality. Two sixteen-year-olds had vigorous homosexual tendencies with aggressive paranoid features. One sought pleasure in spanking small boys. The other was a doctor's son. The father had died when the boy was ten; he was sent immediately away to boarding school. Anything more traumatic would be hard to imagine.

Sibling jealousy of a paranoid kind seems to arise particularly in insecure children when a new sibling is introduced into the family as by adoption or a step-relationship, rather than by the birth of a sibling. It is not difficult to see why. The threat from the introduction of an easily recognisable similar rival must be greater than from the half-expected appearance of an amorphous, characterless infant. Some children hide their uncertainty behind compensatory activity, often of an attention-seeking kind. An insecure boy of fifteen became loutish, boastful, sarcastic and delinquent shortly after the appearance of his step-father.

Compulsions flourish in these personalities. A compulsive idea is fired off by some association. There is considerable anxiety which may lead to very peculiar defensive measures of a bizarre kind. Such compulsive behaviour often allows a release of tension.

Although the insecure personality is found in the lower social groups, a true anankast is rare here. In fact, the anankast is so well-endowed with conscience that he rarely becomes delinquent.

I have only seen one case of true compulsive stealing in this group. A delinquent of fourteen with a basically insecure personality, afflicted with sibling jealousy, brooded for two years after his father's death. Many times a week he dreamed of death and had frequent compulsive death wishes. In relation to his stealing he said, "The temptation comes suddenly, I try to push it out of my head, but it won't budge. I feel a bit better afterwards but not much." He was tortured with conscience: "I don't like the quiet, I keep thinking I'm alone. I like to feel the rain all over me—a clean showery feeling." It was interesting to see that he only stole instruments of aggression—knives, hatchets, tomahawks and chisels. It is tempting to think that, in his stealing, he was acting out his forbidden and dangerous wishes.

In this group there was a high incidence of associated psychogenic symptoms. Excessive timidity and enuresis were particularly well-represented. About a fifth truanted and it is not hard to find reasons. Having played truant for reasons of timidity or feeling cut off from his fellows, the insecure child broods and works over his experiences to such a degree that he is reluctant to return to school and face up to his problems again.

Attention-Seeking Personalities

All these fourteen boys had one thing in common—an urgent need to appear more than they were. Most were vain and there was usually an hysterical flavour to their behaviour. The behaviour certainly served to strike attention. With one exception, the boys were either fifteen or sixteen. Probably there is much more tolerance shown to younger children who boast, lie and exaggerate, features which so commonly occur with this type.

There is persistence of the romancing and flights of fancy of the imaginary world of younger children, although a boy of fifteen, who had " continually to be in the limelight," had already been referred to a child-guidance clinic at the age of eleven. A sixteen-year-old, an only child, determined to get attention at all costs, made a great show of attempted suicide by coal-gas poisoning. He gained a column in the evening paper, where it appeared a very pitiful story. In point of fact, he was an extremely plausible, intelligent and charming liar. Another sixteen-year-old, intelligent, smooth, a good mixer with impeccable manners, was before the court for false pretences. A sixteen-year-old swindler was a real braggart and made a great show of carrying offensive weapons. One boy sought to gain attention by running away. A new step-father had appeared whilst he was away on holiday. However, he had been ear-marked as a pathological liar at the age of ten.

Half these boys were of superior intelligence; another third were above average in intellect. They mostly had a charming veneer. They were certainly likeable and one notes the underlying hyperthymia with its urgent need to perform. It was also interesting to see that many were only children. Only children, who are often lonely, are notorious for their rich fantasies and vivid play with imaginary companions.

Labile Personalities

The main characteristic of these fourteen delinquents was an abrupt rapid change of mood, depressive in type. It is difficult to say whether the mood was reactive, because even the smallest stimulus could provoke a morose, irritable type of reaction.

Stengel (1943), in a study of pathological wandering in which he mentions depressions of this sort, stresses certain features which are not typical of melancholic depression. These are the appearance of certain primitive impulses and the direction of the aggression to external objects, particularly the parents. This is borne out in this small group: four boys were severely aggressive and destructive (two were beyond parental control, one was charged with arson); two more were aggressive (one out of control, another destructive and a fire-raiser). Another young fire-raiser, although basically aggressive, had a false " meek front." It is interesting to note that the aggression is always directed externally. There were no attempted suicides, for instance.

It seems that during the phase, the child, under a strong impulse, secondary to mood crisis, severs his normal relationships with the outer world for a time. This can lead to a fugue state in which the child wanders. Five boys were regarded as persistent wanderers. One in particular, aged fourteen, came from an excellent home where he was well cared for and loved. Although he had never suffered any major upset, he appeared in court for the second time in six months, charged with running away. It appeared that periodically he would become restless and depressed and would then have an irresistible impulse to wander. He wandered far, to Wales and the East coast, with no money and no object in view.

That these boys can be dangerous with their impulsive aggression is illustrated by the boy of eight who had been a real fire-raiser since the age of five. He broke into a garage, threw petrol over a lorry and sat in a car to watch the blaze. It was only when things got out of control that he came to, and crept away. He very frequently wandered, particularly at night.

The possibility of some connection with epilepsy and its associated pathological mood changes is supported by the fact that four of the boys were epileptic. Two suffered from grand-mal epilepsy, one from pyknolepsy and one from temporal-lobe epilepsy following head injury.

Affectionless Personalities

There were eighteen boys in whom it was clear that there was some blunting of the emotions. This was mainly seen in interpersonal relationships, but in some cases concerned callousness and cruelty to animals. There was a complete absence of any sense of pleasure, shame, decency or regret. Most were cold and frigid in outlook and all possessed what has been called " lack of moral feeling." This seems to develop early in life and in one case was alleged to have appeared at the age of six. It cannot be denied that there are connections with the cold unpleasant depressives. Pure cases are rare and it is not uncommon to find small islands of affection, as was the case of an eleven-year-old who had a short " warm spell " after tonsillectomy. This only lasted twenty-four hours and was not seen in the ensuing three years. Remarks like " cut-off," " remote," " no emotions," " loss of feeling," figure prominently in the histories.

Only two boys had not experienced some form of parental separation. Both came from good homes, but, in one case, Fröhlich's syndrome appeared after tonsillectomy at the age of six, and the emotional changes were thought to be associated. Although Bowlby (1947) stresses the importance of early prolonged maternal separation as being particularly responsible for the development of the affectionless character and shows that 86 per cent. of his characters had had this experience, my findings were much lower (eight out of eighteen). In point of fact fifteen out of the eighteen suffered prolonged early separation from fathers and the three who did not, including the case of Fröhlich's syndrome, had the inborn constitutional component particularly stressed.

What is revealing in these fifteen cases is what happened to the child after separation from the father had occurred. In thirteen instances this was just the beginning of a whole train of misfortune. One boy's father went to Burma; shortly afterwards his mother deserted him. When the father returned it was with a new stepmother. Another boy of eleven, completely devoid of any emotional responses, suffered early disruption of home life and has been in and out of the care of the local authority ever since. A fourteen-year-old had entered a T.B. sanatorium at the age of one. Shortly after his return home at the age of five his mother died. A similar state of affairs existed in the case of a child who went into a sanatorium at the age of two and spent several years there; as soon as he returned home, his mother was admitted to the same hospital with pulmonary T.B. More unfortunately, a child lost his father at the age of four through T.B., his mother became ill with the same complaint, and he lived with an uncle from six to eight years of age. His mother married again as soon as he went back to live with her, but died a year later. He has been in local care ever since. A boy of eleven was in care, from one to five years of age, because of parental separation. His parents reunited and he returned home. His father died a year later, and a step-father soon appeared. The boy was said to show very little emotion of any sort.

In the majority of cases, more than one interruption with a parental figure, not necessarily the mother, had occurred. This multiple interruption was stressed by Bowlby for maternal relationships and is frequently omitted by those who seek to refute his work. Thus, in the development of the affectionless personality, maternal separation is but one aspect. It would appear that in a child, constitutionally disposed, a serious disturbance in the child-parent relationship, of such a degree as to be completely lacking or poorly developed, is a particularly potent factor in the unfolding of the affectionless character.

Weakwilled Personalities

This group of twenty-eight individuals was characterised by a weakness of will, with no resistance to the suggestions of others. These boys were very easily led by the whim of their companions; in fact, in eleven instances, bad companions had been directly blamed for the delinquent behaviour, and all but seven had been involved in delinquent gang activities.

Many of these boys yield to group pressures very readily. Sometimes this can be for good and many have displayed good intentions. Transitory influences may rapidly change them, but their good intentions are soon forgotten. They stand out from the other unstable delinquents because they are so docile, amiable, pleasant and unassuming. Even at sixteen they can be described as " indolent, weak and pleasant," and it has been suggested that the presence of a weak will at this age is indicative of a delay in maturation. A twelve-year-old, the son of a subnormal mother living in extreme squalor, wandered aimlessly around and was very weak and easily influenced. Some are so dull-witted, feckless and pliable as to be unable to see very far ahead. Eight boys had IQs less than 70; two of these were ascertained as E.S.N. A further eleven had IQs in the dull-normal range (70–90). Only three had IQs over 110.

Contrasting with the affectionless personalities, no boy had been separated from his mother, and only three had experienced an early separation from the father. Only nine boys came from broken homes. Hence it seems that these boys just drift into delinquency as part of a group activity and display few if any powers of resistance due to an inherent lack of will. There were no aggressive traits; in fact, three boys were remarkable for their timidity. Only five boys had played truant and even this seemed in each case to have been someone else's suggestion. The clinical impression is that few of these boys are emotionally disturbed and they just seem to have gone with the crowd.

Asthenic Personalities

Here, the personality is such that fatigue and a feeling of uselessness are readily induced; these in turn produce a state of more or less constant internal hypochondriacal scrutiny.

Normal body function requires a healthy mental indifference. As soon as body functioning becomes the focus of interest, normal smooth-running is interfered with. Asthenics take a morbid interest in the functioning of their internal organs. They make much of minor disturbances such as fatigue, sleeplessness, headache and heart irregularities, and sometimes lose the carefree attitude to mental functions and, in the same way, dwell morbidly on reduced mental powers, concentration and memory. Depersonalisation can occur, as can derealisation. Asthenics are usually very sensitive and hate blood, noise, the sudden and unexpected. Frequent depressions can arise from the depths of the personality.

Children readily exploit their bodily inadequacies and their mothers' anxiety. They very easily avoid school with their asthenic tendencies. These tendencies are more readily elicited in only, first and youngest children. Out of seven boys thought to have asthenic personalities, only two occupied an intermediate position in their families. Three boys had elderly invalid parents, the remainder had parents who were well-advanced into middle age, and at least one of these was a chronic invalid.

Asthenic boys tend to be remote and truanting is common. The boy will readily exploit these tendencies, stay at home and be very reluctant to return to school. Three boys were before the court because of serious truancy, and the remainder committed crimes alone whilst truanting.

In five cases the asthenic features appeared after a period of hospital treatment. A boy of thirteen had just spent six months in a sanatorium; as his IQ was normal, his reading age only 10, and his arithmetic age 9, it is not surprising that he was reluctant to return to school. Another boy had had many hospital admissions on account of " delicate health." He had a very poor relationship with his parents and was timid and apprehensive. He spent more time away from than at school.

A dullard of fifteen oscillated between his natural and adoptive parents. He had spent a considerable portion of his life in various hospitals, but never once was it possible to make a proper diagnosis. Any difficulty in his life had been met by withdrawal into his illnesses, particularly " stomach pains." He had been labelled as suffering from a psychosomatic disorder. A paediatrician said: " He has a morbid interest in his own ill-health and is fast becoming a chronic hypochondriac."

Two boys, without histories of prolonged hospital attention, produced psychic disturbances with flagging after stress. One in particular was a grammar school boy, quite bright, who had to travel twenty miles a day in a taxi to school. He became very tired and worried incessantly about his mental and scholastic ability. He was an excellent reader but had lagged behind in mathematical subjects. He had an excellent home and had been brought to court for persistently refusing to go to school.

Conclusions

In the absence of simple meaningful ways of assessing delinquent personalities, much attention has been focused on the external environment, and the basic personality has tended to be neglected. This is surprising, because it is obviously the interaction of specific personality patterns with certain life-experiences which goes to explain delinquent activity. What is minor stress for one, calling for adjustment, may touch on some hidden reef of the personality of another and serve to deepen further inner tensions and conflicts. That there is an inherent constitutional element involved in this can hardly be denied.

Furthermore, amongst those who have had practical experience of assessing delinquents, there can be few who believe that they are continually dealing with essentially normal, healthy children. Yet it is remarkable how infrequently the concept of abnormal personality is raised.

This study is an attempt to present such a concept of abnormal delinquent personalities. One-third (175) of the boys studied had such peculiarities of personality as to make it simple to label them clinically as suffering from abnormal personalities in Schneider's sense.

An attempt has also been made briefly to trace how certain constitutional predispositions have unfolded in such a way with life experiences to produce these deviant personalities and so cause either the delinquent or others to suffer.

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CURRENT SURVEY

RESEARCH AND METHODOLOGY

CURRENT RESEARCH LXXXII

(Continued from Vol. 2, p. 377)

A SERIES of studies of methodology in criminological research

(1) *Name of University Department, Hospital or other Institution or private person supplying the information*: The Survey Research Unit, London School of Economics and Political Science.

(2) *Subject of Research*: This five-year inquiry is to consist of a number of separate studies of methodological issues in criminological research. Several projects within the series are in progress.

(a) The first of these is aimed at the development of special techniques for eliciting from boys certain personal details (including undetected delinquent activity) vital to studies of juvenile delinquency. It is at present in an exploratory stage. The technique so developed will be subject to validation. Mr. M. Beeson is responsible for the project.

(b) The second project in the series is a study of the research potential of official documents dealing with the background of delinquents. It deals with the completeness of the information provided in them, in the sense of determining the percentage of boys about whom a particular element of information is provided. Mr. R. Hood is responsible for the project.

(c) Other projects in the series include techniques in hypothesis development; research designs for testing hypotheses about aetiological factors and situations in juvenile delinquency.

(3) *Under whose auspices is the research being carried out?* The series is being financed by the Home Office on the basis of a grant to the Survey Research Unit of the London School of Economics. The series is under the direction of Dr. W. A. Belson.

(4) *Commenced*: October 1961. *Completion expected*: The study of documented information is scheduled for completion by the end of 1962. The series as a whole will continue until 1966.

(5) *Publication*: Reports of specific projects will be published as completed, the first of them by approximately mid-1963.

CORRECTIONAL SYSTEMS AND NATIONAL VALUES *

NORMAN S. HAYNER †

THE correctional systems of different countries can be compared statistically. Many will have unusual features. These can be analysed in terms of the distinct cultural settings. It is the purpose of this paper to make an attempt (1) to place five selected systems on a theoretical continuum from extreme emphasis on punishment of offenders to extreme emphasis on treatment and (2) to explain unique features of these systems in terms of national or regional values.

To determine the position of a given country or state on the punishment-treatment continuum the following empirical criteria have been used:

1. *Sentencing.* Extent to which pre-sentence investigations were used by judges. It was assumed that this was an index to the consideration of personality and social background in addition to the crime.
2. *Probation.* The ratio of probationers to prisoners, the quality of probation officers, as measured by training and experience, and the caseloads which they carry.
3. *Architecture.* Size of correctional buildings and degree of departure from traditional Pennsylvania or Auburn types of architecture.
4. *Personnel.* Method of selection and training of correctional personnel.
5. *Maternal and child care.* The methods used in handling women prisoners who are pregnant or mothers of small children.
6. *Classification.* The degree to which the admission study is professional and the extent to which it is followed by the classification authority.
7. *Work by prisoners.* Extent to which prisoners are employed, the diversification of this employment and the degree to which remuneration approaches that for similar work outside the prison.

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* During the summer of 1960 thirteen European prison wardens gave generously of their time to help with this study. For four persons—Alan Bainton, Governor of Wakefield Prison in England; Norman Bishop, Governor of Pollington Borstal, England; Dr. Otto Rudolf, Director of the Landesstrafanstalt Bruchsal, Germany; Miss M. E. G. Stocker, Governor of Askham Grange, an English open prison for women—this meant from seven to eleven hours each. In addition, substantial assistance was given by Calixto Belaustequi, Inspector General of Spanish prisons; C. T. Cape, Assistant Prison Commissioner for England and Wales; Dr. Walter Cappel, German psychologist; Federico Castejón, judge of the Supreme Court of Spain; Dr. Albert Krebs, Director of Corrections for the State of Hessen in Germany; Dr. Wolf Middendorff, judge in Freiburg, Germany; Dr. Wilhelm Pauli, Director of Corrections in the State of Baden-Württemberg, in Germany; Ernest Palola, pre-doctoral associate, University of Washington; Alfons Wahl, German Federal Ministry of Justice.

This article is the revised edition of a paper read in Spanish at the Eleventh National Congress of Sociology in Ciudad Victoria, State of Tamaulipas, Mexico, November 1960, and published in the *Revista Mexicana de Sociología*, XXIII: 215–223 (enero-abril, 1961). Permission to publish in English was granted by Dr. Lucio Mendieta y Núñez, president of the Mexican Sociological Association.

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8. *Education.* The variety of educational services and the percentage of prisoners who participate.
9. *Handling of escapees.* The extent of individualisation and the severity of punishment for escapees.
10. *Visits and letters.* The frequency, length, and informality of visits and the frequency of letters.
11. *Parole.* The percentage of prisoners released under supervision; the caseloads and the quality (training and experience) of parole officers.
12. *Statistics and research.* The standards reached by correctional statistics and research.

By means of long interviews with key officials or through first-hand experience [1] data on each of these criteria have been gathered from the various jurisdictions. These facts have been evaluated by the writer to determine where the political entity should be placed on a seven-point punishment-treatment scale. A score of one means extreme emphasis on punishment; seven, extreme emphasis on treatment. On the basis of judgments made by five European correctional administrators all items have been given a double weighting except 3, 5, 9 and 12. The results are shown in Table 1.

It will be noted that the governmental units included in Table 1 have been limited to Mexico, Spain, West Germany, Western United States and England. Spain and England have national prison systems; the United States and Mexico have both federal and state systems; Germany has a federally established body of criminal law, but administration is in the hands of the states.

The two German states (*Länder*) of Baden-Württemberg and Hessen were studied independently and given ratings of 77 and 93. They were then averaged to get the score for Germany. The correctional system of the former is considered by administrators about average; of the latter, better than average for Germany. If data were available for all the *Länder*, the city-state of Hamburg would probably be at the top; Rheinland-Pfalz, near the bottom.[2]

On the basis of many contacts with the correctional system for the state of Oaxaca in southern Mexico, the rating was 48. A three-hour inspection in 1960 of the penitentiary at Ciudad Victoria, capital of the state of Tamaulipas in northern Mexico, supplemented by information from a local judge and from a representative of the prosecutor's office, suggested a rating of 56.

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[1] Four weeks were spent in 1954 and 1960 studying the correctional institutions of Spain with visits to ten establishments; an equal time in England with inspections of eleven prisons and borstals; and five weeks in Germany with visits to fifteen institutions. Between 1941 and 1961 the writer visited fifteen correctional facilities in Mexico—two of them many times. He has taught courses in criminology at the University of Washington in Seattle for thirty-seven years and was on leave for five years (1951–56) to serve full time as member and chairman of the Washington State Board of Prison Terms and Paroles.

[2] In 1958 Hamburg had one probation officer for every 62,331 of the estimated population for that year; Hessen, one for 98,968; Baden-Württemberg, one for 158,161; Rheinland-Pfalz, one for 209,669; Saarland, one for 346,733. The ratio for West Germany was one for 140,512.

TABLE 1

PUNISHMENT-TREATMENT RATINGS FOR SELECTED CORRECTIONAL SYSTEMS

Criterion	Mexico	Spain	West Germany	Western United States	England
* 1. Sentencing	6	6	9	10	8
* 2. Probation	4	4	5	10	10
3. Architecture	3·7	4	5	4·3	6
* 4. Personnel	4·7	10	11	10	12
5. Mothers	4·3	7	2·5	1·3	4
* 6. Classification	4·7	10	9	10·7	12
* 7. Work	8	12	12	8·7	10
* 8. Education	6	8	8	10	12
9. Escapees	3·3	3	5	3	5
* 10. Visits	10·7	4	7	8·7	12
* 11. Parole	2	2	7	10·7	10
12. Statistics	1	3	4·5	4·7	6
Total	59 †	73	85	92 †	107

* Double weighting for this criterion.
† Corrected for error of ·1 due to rounding.

Extended study of the correctional system of the Federal District (includes Mexico City) gave a score of 73. The ratings listed for Mexico are, therefore, averages for these three jurisdictions.

The Western Region of the United States includes both the Mountain and Pacific Divisions with a total of thirteen states. The correctional system of California easily ranks at the top from the standpoint of emphasis on treatment with a score of 122 points out of a possible 140. It was given the top evaluation for sentencing, personnel, classification, education, and statistics. It would be matched by the U.S. Bureau of Prisons which has thirteen institutions and many probation departments in this Western Region. The Bureau may be a little higher in probation and architecture but slightly lower in sentencing, education and statistics. The state of Washington with a rating of 107 is probably a bit more treatment-oriented than five other states in the region (not counting California). Montana with a rating of 47[3] (the lowest possible score is 20) is roughly similar in punitive emphasis to the five remaining states. This low score pulls down the average for the Western United States to 92.

As to the economic, social and criminal situations in the regions included, Mexico is a country in transition with a low average standard of living and a preponderance of crimes against the person, but in the rapidly growing cities increasing rates for offences against property. The Western portion of the

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[3] Benjamin W. Wright, graduate student in sociology at the University of Washington and formerly Director of Parole in Montana, provided the ratings on the twelve criteria for his home state.

United States has a high standard of living, high urbanisation (especially on the Pacific Coast), a high degree of residential mobility in its population, and high rates for such crimes as robbery and burglary. England and Germany are in the northern belt of Western European countries which in general are more industrialised, have higher standards of living, and higher rates for crime and imprisonment than countries like Spain which are located in the less industrialised and less prosperous Mediterranean belt.

Examination of the ratings for specific criteria in Table 1 reveals that the sharpest gradients between the five jurisdictions are to be found in the handling of pregnant offenders and for statistics, visits, parole, probation and education.[4] Comments are made below on the handling of mothers, visits and education. Correctional statistics and research are almost absent in Mexico, but they profit from a million-dollar annual budget in California. Except for the possibility of revocation and incarceration if caught by the police in a criminal act, supervision for adult probationers and parolees is lacking in Mexico and Spain and insufficiently provided in most of Germany. Mexicans, Spaniards and many Germans in these statuses are, therefore, actually free men. But supervision by trained and experienced salaried officers is generally regarded as essential for adequate treatment of persons on probation or parole.

Probably more interesting than this attempt to make general comparisons between governmental areas is the fact that different countries or regions tend to have unique correctional practices. An attempt is made below to explain such differences in terms of national or regional values.

In Mexico, for example, it is the custom to permit well-behaved prisoners to have conjugal visits. This means that these prisoners are permitted to have sexual contact with their wives either in their cells or in a designated section of the prison. The new penitentiary for sentenced offenders in the Federal District provides special rooms for the purpose. This custom appears to be rooted in the strong emphasis on family in Mexican life and a feeling that conjugal visits keep couples together. Marital rights here take precedence over punishment of the criminal, whereas the reverse is true in most other countries. Home visits are, however, permitted in Sweden, Poland, Argentina and (once during a prison term) in England.[5]

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[4] In Germany, England, Mexico, and Spain escape by a prisoner alone is not a crime. It is regarded as something to be expected of confined men and is punishable by some such method as isolation on reduced rations for two weeks. The ratings for this criterion were complicated by lack of individualisation in the handling of escapees in certain prisons and the extreme measures taken by some directors to prevent escapes.

[5] See Ruth Shonle Cavan and Eugene S. Zemans, "Marital Relationships of Prisoners in Twenty-Eight Countries," *Journal of Criminal Law, Criminology and Police Science*, XLIX, 133–139 (July–August 1958). Conjugal visits are permitted in Cuba, in certain other Latin American countries, and in selected prisons of Sweden and Yugoslavia. Upper-class prisoners are probably permitted such visits in all Latin American prisons. Some prison directors in Mexico also permit prostitutes. This seems to reflect admiration for the person who is *macho, i.e.*, exhibits physical courage, loyalty to a group, and sexual prowess.

Spaniards, in contrast to Mexicans, are horrified at the idea of conjugal visits. Visiting arrangements for husbands and wives usually give emphasis to physical separation. The most unusual feature of Spanish corrections is in the handling of women with small children. The Centre for Care of Mothers and Children (Centro de Maternología y Puericultura) in Madrid is the outstanding institution of this type in Western Europe. From all over Spain pregnant felons with sentences of three years or more are sent here. Excellent facilities and medical care are provided for these women. Mothers who nurse their children sleep in a separate dormitory and get one day off their sentence for every day they continue nursing. If satisfactory provision for the children cannot be made by families outside, mothers are permitted to keep their youngsters with them for as long as four years. In special cases the children may stay until seven years of age. They do not hear the word "prison." They think of the institution as a hospital. Girls and boys sleep in separate dormitories while their mothers sleep near them in open-top cubicles containing three beds each. Spaniards feel that keeping the children and mothers together does something constructive for both.

As compared with other European countries, juvenile delinquency rates are low in Spain. Spaniards believe that anything which will strengthen the bond between parents and children should be encouraged. On the Day of Our Lady of Merced, for example, all young children of prisoners are permitted to visit their parents within walls. Toys are given and entertainment provided. Although the importance of family is stressed in both Spain and Mexico, the stronger control exercised by the Roman Catholic Church in Spain is probably one factor accounting for the greater emphasis there on the parent-child rather than the husband-wife relationship.

A distinctive feature of the German system of corrections is the persistence of a programme of isolation. The so-called Pennsylvania style of prison architecture, with its separation of prisoners night and day, was introduced first into England and shortly afterwards (1846) into Germany. Thirty years ago in England there was a strong movement away from this programme. Such a movement is more recent in Germany. When each prisoner is sleeping, eating and working alone in his cell, it seems to satisfy the systematic and orderly qualities so prevalent in German life. It is like the precise arrangement of every object in the typical middle-class German household.

The movement away from this emphasis on isolation was facilitated by the prison division of the American occupation government in conjunction with the English occupation group. Modifications have been faster for youths than for adults, however. This trend is illustrated by the institution for older delinquent boys at Hahnöfersand near Hamburg with its stress on education, and by the open, borstal-like school for youths at Staumühle in Westphalia. The new Gustav Radbruch-Haus in Frankfurt (Hessen) represents the most radical departure from isolation-oriented corrections for adults. A transfer institution, it houses prisoners for an average of three months prior to release. Many of its inmates work under supervision in local factories or farms during the day and sleep in the prison at night. In fact the shift in major institutions for adults in Hessen and in the Schwäbisch-Hall Youth Prison and the Bruchsal Landesstrafanstalt of Baden-Württemberg is toward isolation at night for sleeping, but toward working, eating and getting their recreation together during the day.

In addition to the orderliness appeal made by the Pennsylvania system, there is also a general feeling on the part of German citizens that what happens behind prison walls "is not our business." An old proverb is pertinent: "Do not go to your Prince when you are not called" ("Geh nicht zu deinem Fürst wenn du nicht gerufen wirst"). It has been a Prussian idea that you should do what you are supposed to do and not bother about other people. During the Hitler régime perhaps 90 per cent. of the Germans, so they affirm, did not know or think about the concentration camps. Methods of measuring the extent of detachment from public view would be the number of visits to prisons by distinguished persons (ordinarily not many) or the items about prisons in the newspapers of a state (also not many). The development of a multi-party prison commission in the Hessen parliament is one move away from this attitude.

One of the most unusual correctional practices in the states of Washington, California and Hawaii is sentencing by an administrative board. In Washington State, for example, judges set the maximum sentence, largely under control of statutory provisions for each crime, but the minimum sentence is set by a full-time board of five members appointed for staggered terms of five years each by the governor. The board is aided in this decision by an admission summary prepared by a professional staff and by an interview with each prisoner. Although the trend is toward appointment of men of competence on this board, many purely political appointments have been made. The method makes possible, however, consideration of personality and situational factors as well as the specific crime and criminal record. It has to a considerable extent equalised the widely varying sentences of individual judges for similar patterns of crime, personality and social situation.

This method of sentencing was established in 1935 after a bloody riot at the penitentiary. Inmates had complained bitterly about sentencing by judges. More recent improvements in the quality and training of personnel for probation, institutional treatment, and parole also followed serious riots at both the reformatory (1953) and the penitentiary (1955). These riots served to focus public attention and to convince both political parties of the need for improvements. Changes were facilitated also by the lesser importance of tradition and the greater willingness to experiment that characterise the Pacific Division of the United States.[6]

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[6] In Hawaii an administrative board sets the minimum sentence, but its decisions are subject to review by judges. Due to the predominance of highly indeterminate sentences, such as one year to life, the California Adult Authority has what amounts to sentencing power.

England provides a noteworthy programme of education for its prisoners with a rich variety of courses taught by competent teachers from the outside community and participated in by a high proportion of inmates.[7] More unusual, however, is one aspect of its work and classification programme. As long ago as 1954 the writer visited a small, barrack-like structure in the yard, but inside the wall, of the Bristol local prison. From here a small group of long-term, recidivist prisoners, in the third and last stage of England's preventive detention programme, went out each work-day morning to jobs in the city of Bristol and came back each evening. They earned the same wages as employees who were not prisoners; they were able to resume responsibility for the support of their families; and they saved a substantial sum toward eventual release. Occasionally one of these men would become too drunk or in some other way violate this privilege and have to be returned to close confinement, but in general the results have been sufficiently encouraging to enable establishment of eight such centres by 1960 with six additional " hostels " planned.

There were twenty-three prisoners housed in the " hostel " of the Wakefield Prison in August of 1960. They bring their wages intact to the supervisor who pays for the support of families that had been on national assistance, gives the prisoner his expense money for midday meals and transportation, allows him up to 30 shillings (4·20 American dollars) per week pocket money. Income averages £9 15s. (27·44 American dollars) per week. Average amount saved for release is £57 or 159·60 American dollars. All prisoners with sentences of over four years spend their last nine months here. Out of fifty who have been released for twelve months or more, only one has been reconvicted.

At the women's open prison at Askham Grange the writer met informally with twelve members of the " going out group." The group showed a surprising degree of ease in conversation and of self-confidence. They not only talked briefly concerning themselves but also asked questions about prisons in America. One older woman, a " nine-time loser," was now waiting on tables in a restaurant. A well-educated younger woman, who had acquired £800 (2,240 American dollars) through some " cock and bull story," was receiving good pay in a factory and saving money so that she could support her two children when released. Another woman working as a gardener was an alcoholic. Three worked in nursing jobs at local hospitals;

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[7] For additional information on England and the other countries discussed the following articles by the author are pertinent: " English Schools for Young Offenders," *Journal of Criminal Law and Criminology*, XXVII: 696–705 (Jan.–Feb. 1937); " Recent Observations of Mexican Prisons," *Proceedings of the American Prison Association*, 1941 (Spanish translation: *Revista Mexicana de Sociología*, IV: 73–83, 1942); " German Correctional Procedures: Impact of the Occupation," *National Probation and Parole Association Journal*, I: 167–173 (October 1955); " Notes on the Spanish Correctional System," *Federal Probation*, XIX: 48–51 (December 1955); " Sentencing by an Administrative Board," *Law and Contemporary Problems*, XXIII: 477–494 (Summer 1958); " Why Do Parole Boards Lag in the Use of Prediction Scores? " *Pacific Sociological Review*, I: 73–76 (Fall 1958).

another worked at a race track; still another as a hotel maid; and one even worked in a brewery. They were housed separately from the other women. It was the writer's impression that this combination of supervision at night with work outside during the day was making a contribution to their reformation. In the words of the governor, "they gain new life and new hope."

The development of "hostels" in England seems to be tied up with a willingness to experiment which has characterised the English correctional system during its last fifty years. The Borstal institutions for young adults which reached a high state of rehabilitative efficiency in the 1930s are another example of this principle.[8] More recently the Norwich plan has given prison officers more responsibility for the individual rehabilitation of the prisoners under their care. Certain personalities such as Alexander Paterson, W. W. Llewellin, and Lionel Fox have won public confidence and contributed much to improving the personnel and encouraging experimentation. Members of the House of Commons do ask questions of the responsible minister, but they place trust in civil servants and do not interfere politically with their work.

To conclude, it has been demonstrated in an exploratory way that correctional systems can be placed on a punishment-treatment continuum. Mexico, Spain, West Germany, Western United States and England were distributed in that order on such a scale. Attention has been given also to the relation between certain unique correctional practices and distinctive values held by the people in the jurisdictions where these practices have developed. Additional studies in other political entities would help to test and sharpen these ideas.

A CASE OF MENTAL SADISM

C. KLEIN *

THE word sadism calls up in us a feeling of aversion but this is accompanied at the same time by a feeling of lust. We know that the Spaniards derive great enjoyment from bull-fights, but when we Dutch watch this national sport we feel somewhat embarrassed. We feel a much greater aversion when we come into contact with mental sadism, but we try to deny the fact that there is a feeling of lust in it.

Helpless victims, such as civil or public officials, employees of large industrial plants, novices or students are often subjected to mental sadism. Mental maltreatment of children is uncommon but unfortunately the judge can do little in most of these cases.[1] The author frequently meets patients who complain of being tormented by their neighbours and briefly recalls two cases of tremendous vexation which impressed him deeply.

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[8] See William Healy and Benedict S. Alper, *Criminal Youth and the Borstal System* (New York: The Commonwealth Fund, 1941). "Flexibility is a cardinal principle," they write, "reflected in every feature and department of the system" (p. 85).

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[1] See Clemens-Schröner, B.L.F.C. Psychische Kindermishandeling. Gravenhage: Nyhoff, 1956.

1. A middle-aged woman, living in an upper flat, which was anything but soundproof, felt completely persecuted by the tenants below. Her every step, her comings and goings from one room to the other, her use of the bathroom had been imitated by the lower tenants for the past year. When she opened the window, the neighbour's window was flung open; when she flushed the toilet, the sound was repeated a second later in the lower bathroom. Finally, her only recourse was to move.

2. An extremely nervous woman came seeking advice. She was an immaculate woman who took great pride in her spotless house. Her husband was tormenting her cruelly by throwing moist balls of paper into the stove. As they smouldered, he would remove the lid of the stove and sit back apparently enjoying the smoke which filled the whole room. His wife endured this for a long time before she consulted the author.

Experienced investigators know how difficult it is to charge these people. The offenders keep on the right side of the law and do so little evil otherwise that the public prosecutor is unable to convict them. These difficulties are clearly evident in the following case-history. In this instance, there is a great contrast between the deep hatred of the delinquent and the comparatively minor offences through which he so disrupted the lives of his victims. Previously sentenced and intelligent enough to appreciate his own behaviour, one would have thought that punishment would have taught him a lesson. However, those who knew him were able to predict that the court would see more of this young man in the future.

This contradiction demonstrates an inner conflict in the minds of all the authorities concerned in this case. All the investigations were thorough. The public prosecutor, judge and counselling officer had the impression that they were doing their utmost to guide this young man in the right direction, were acting in accordance with the law, attempting to correct and make a more honest person of him while, at the same time, protecting society. Nevertheless, they doubted the value of their combined efforts. The man was sentenced, but was it possible to extinguish the burning torch which had already fired the lives of so many?

Prior to describing the actual happenings and outlining what should have been done, the following are a few background notes limited to some anthropogenetic features on the one hand and to some environmental factors on the other.

His paternal grandfather was not only a sexual degenerate, but also morbidly jealous of the good fortune of others. Once, when the performance of an entertainer drew a storm of applause, the grandfather stole the show by continuing to clap vigorously long after the others had ceased, drawing their attention to himself—a handsome man in the uniform of a chief steward. At the height of a celebration in honour of our delinquent's father, a restaurateur, the grandfather pushed his son causing him to strike his head against the tap so severely that he was no longer able to enjoy the festivities.

The delinquent's father was a philanderer, who was also very vain and a quick-tempered drunkard. He cared little about his restaurant, his life and soul were in his personal fame in the small town where he lived. One of his most outstanding characteristics was an unquenchable thirst to nag others —a kind of sneaky baiting.

No outstanding features were to be noted on the maternal side. The mother's background was normal. The only comment that can be made is that she was a weak person, especially in her attitude to her husband, her son and everything in which her guidance was needed.

The subject of this case, an only child, was born in 1921 when the family lived above their restaurant. In childhood he enjoyed being the centre of attention and was a real problem child, always whining, constantly clinging to his mother, continuously demanding. He tolerated no delay in the fulfilment of his needs and whims, whether a shampoo or a hot bath, otherwise he would throw a tantrum and screech until the diners rushed up the stairs to interfere. Of course his mother would always give in to him. She had to rock and push his pram constantly and was never allowed to sit down and rest. Her social life was completely barren because of his demands for attention, his continuous whining and tugging; she could neither pay social calls nor receive visitors.

When older, he proved to be so jealous that he would berate his mother when on Fridays she served eggs to the maid who disliked fish. Whenever his maternal aunt visited them, unable to endure the pleasure which the sisters took in their conversation with each other, he would bait and tease them into tears. When in desperation his mother sent him to bed, his father would go upstairs and give him a glass of lemonade. However, whenever his father tried to punish him, the son would take revenge. His retaliation consisted in piercing both eyes of his father's portrait and burning his father's souvenirs of soccer and music club events. He did it all for revenge.

His jealousy was always directed at people in his close environment, such as the clerk who had served his father reliably for many years. The mother had frequently noticed that he begrudged his father's friendship with the clerk and could not tolerate his complete trust in him. On one occasion, when all were watching a parade, his mother noticed that some gin was missing from the bottle, though no customer had ordered any. The son immediately tried to throw suspicion on the clerk, and had actually poured the gin down the sink in an attempt to compromise him. Another time, he stole his mother's set of diamonds, a present from her husband, not for lack of money, because he was allowed to keep his earnings, but just to vex his parents. Then again, he stole and sold her set of silver spoons; but his mother was strongly convinced that he did it only to torment her in revenge for some punishment or withdrawal of privilege. The theft was discovered when one of his many "fiancées" gave him away to his mother.

By the time he was twenty years old his reign of terror had reached such proportions that both parents trembled with fear. Once he overturned the table set for dinner; another time he tried to choke his father, at which point the police were called in. When he was earning more money than his father, the son lent him money several times. However, when he tried to claim it back, the father would put him off with fair promises, which only increased the tension between them. When his father requested a weekly contribution of 20 guilders from his son for room and board, he became outraged and moved out of the house. Although he had a very cramped bed in a rented room, he appeared satisfied and maintained his pride. At first he declined his mother's visits, but later was delighted to see her. When he met the girl he married, he described his parents as black as pitch, so convincingly that his future parents-in-law believed him. He said that he had had an awful life as a youth and had a bad father and that his mother was an evil woman.

In married life he was sexually cold and his wife related that he had very little desire for intercourse which she mainly had to initiate. But as far as their female friends and acquaintances were concerned, he was still the same Don Juan as before their wedding. "He did not care about me; he knew how I craved for a baby; he was a real sadist." His wife denied corporal sadism. All he wanted was his motor-cycle and scooter.

The following striking story was related to the author by the wife's friend in a neighbouring town and gives a good insight into his character. It is a very sober story and for that very reason it is evidence which speaks for itself: "Yes, Doctor, X was always very nice to me, so cordial and courteous.. He came to see me one evening just after buying his new motor-cycle and found me very depressed over my mother's death the week before. It was a balmy summer evening just before twilight and knowing that X could cheer me up whenever I was down-hearted, I accepted his invitation to a drive. It was dark by the time we arrived in the Hague woods. He stopped and, in short, he tried to initiate sexual intercourse. He became very angry when I refused to submit and left me alone in the forest, knowing how nervous I am of the dark. I became even more terrified when I could not make my way out of the woods. Fortunately a passer-by heard me crying and led me out to the road."

Going back a few years: on completion of his schooling, he had obtained a good administrative position in a chemical plant, where he committed his first offence. Until then he had never committed any crime or offence punishable by law. His lust for tormenting was mostly spent on his wife, his parents and his chief; the last was always stirred up by stories about his competitors who had a chemical plant just next to his. As X's wife was related to this competitor, he was believed, although the information he supplied was only to incite and torment his chief.

His criminal record shows the following:

1 Court of Justice, 2/11/1955	Embezzlement committed by a person who had access to the goods by virtue of his job	2 months' imprisonment; sentence suspended.
2 Court of Justice, D 15/2/1957	Libel	2 months' imprisonment.
3 Court of Justice, D 15/2/1957	Libel	4 months' imprisonment and committal to the State Institute for Psychopaths.

Following a thorough study of his criminal record, it appears that all three offences had been committed out of lust for tormenting his victims.

In the first case he stole a list of addresses and notes concerning customers and chemical materials manufactured. He did not make any use of this information, only kept these addresses at home and did not return the list to his chief on being discharged from work. Approximately a year later, he sent the list to the Director of the firm and enclosed an anonymous letter stating that an unknown person had sent the list to an important competitor in the chemical industry. When apprehended, he denied everything at first. Because he did not exploit chemical secrets or the customers, he was charged only with stealing confidential papers belonging to the chemical firm. After a while, he finally admitted under pressure: " I was brooding on revenge after being fired. I wanted to intimidate my former boss."

The second offence was a libel concerning one of his friends who was applying for a better job. Jealous, he again sent an anonymous letter, besmirching the reputation of his friend and claiming that he had been a traitor during the war and had caused the death of many Jews. Afterwards he admitted that he had done this out of jealousy and more particularly because his friend had married his former girl friend. At the same time he wrote anonymous slanderous letters in code, enclosing a partial key to the code, and addressed the letters to his friend's wife and to all her relations. After a while he sent the rest of the code.

A psychiatric expert was appointed in both instances. The first expert—in the 1955 case—concluded that they were dealing with a maladjusted personality with a sensitive character. His opinion was that a relapse was extremely unlikely; he saw it as a single occurrence. He did not even mention the sadistic traits. The second expert—in 1957—described the young man as a hysterical psychopath. He reported convincingly on his great unreliability. Again no mention was made of the sadistic traits which were actually at the root of all his actions. This expert gave as his opinion that a relapse was unlikely and advised careful supervision. In both cases the final conclusion was that he could not be held fully responsible.

On one occasion the public prosecutor received a complaint from "an old lag," to the effect that a detective had spoken of him in a derogatory manner, this detective being one of the principal figures in the judicial inquiry into the case of our delinquent. When the public prosecutor tried the "old lag," it became evident that he had not voluntarily drawn up the complaint, but that the delinquent had instigated him to do so and had also framed the complaint. This fact is evidence of his deep hatred, his urge to take revenge. Although well aware that he was on probation, he could not refrain from libel.

Later he forcibly entered the residence of his wife, from whom he had been separated as to bed and board, knowing that she was abroad on holiday. He entered via the kitchen with the intention of finding evidence of relations between his wife and some man. The week before, on her birthday, he had picketed her house. He spent all day making slanderous remarks about her to the neighbours who were eager to listen to gossip about this nice-looking, young divorced woman, who was perhaps celebrating her birthday with some other man. The delinquent spoke so convincingly that a neighbour gave him a cup of tea. What is to be done when he next libels someone and is on trial again?

It was soon evident that he would resume his intrigues after serving his sentence; he would continue his tormentings and defamations of character. The experts did not judge it necessary to provide institutional rehabilitation. Nevertheless, after the second offence, the public prosecutor recognised the sadistic elements in the subject's character and demanded conditional placement in the State Institute for Psychopaths. (In this institute there is no psychotherapy). The author's opinion is that it would have been preferable to sentence him to a re-education institute immediately following his first offence, even though it was a minor one. Dr. Clemens-Schröner (1956, p. 299) says: "In modern jurisprudence it is not important where the delinquent is placed, whether in prison or in a corrective institution. The only important thing is to cure the criminal tendency." In this case confinement in the Van der Hoeven Clinic in Utrecht, Holland, would have been advisable for a period of two to three years, the normal time required for psycho-analytical treatment of an average neurosis.

NOTES

AN APPRECIATION OF PAUL REIWALD, Dr.Jur.*

LEON WURMSER

As is well known, it has been much harder to introduce psychoanalytic concepts into criminology and the study of criminal law on the Continent than in Anglo-Saxon countries. Even today there is only a small number of workers who avail themselves of this science, no longer new, when considering criminal law reforms. In this field the most important pioneer in the German language was Paul Reiwald.

He was born in Berlin in 1895 and after a classical grounding studied the history of art. He volunteered in 1914 for the First World War and returned wounded in 1915. He concluded his legal studies in 1923 and from then till 1933 practised as a lawyer and, in particular, as defending counsel in Berlin. At this time he also lectured on the psychology of the criminal at the Humboldthochschule. His first book, *Moabit* (so named after the famous Berlin prison), describing his experiences during this period, was proscribed by the Nazis in 1933. Being a Jew, a socialist and a member of the League for Human Rights, Reiwald had to leave Germany shortly after Hitler seized power. He went first to Belgium (1933) where he became General Secretary to the Belgian Zionist Party and gave lectures in Brussels University, then in 1939 to Geneva. In 1944 he became "*Privatdozent*" in Geneva University, and in 1951 he was invited to give a course of lectures on "The Psychology of Wayward People" in Zürich University. These he was not able to start since, in August of that year, he died at the age of fifty-six.

During the latter years of his life, Reiwald published a number of important books which undoubtedly numbered amongst the best hitherto written in this particular field: *Die Eroberung des Friedens* (1944), *Die Gesellschaft und ihre Verbrecher* (1948, trans. *Society and its Criminals*), the large *Vom Geist der Massen* (1948), and *Das Bedrohte Ich* (1951). In addition he contributed a large number of articles to newspapers and in books (for example, to H. Meng's *Prophylaxe des Verbrechens*). He was also an active member of the Arbeitsgemeinschaft für Psychohygiene and provided an essential stimulus to considerations of problems relating to crime prevention and the treatment of criminals (for example, his collaboration with André Repond, Elisabeth Rotten, Sigwart Frank and others).

Reiwald utilised not only his wide knowledge, apparent in all his books, but also his warm human sympathy, together with his original and radical outlook to attack the time-worn and inevitable prejudices. He showed how such solid "pillars of society" as the principles of punishment are in fact nothing but neurotic symptoms of society, similar to the forces in the individual which help to a small extent to repress and divert violent aggression into other channels but not to neutralise it. Justice is done without seeing the criminal as an individual. Punishment has for its ostensible purpose expiation and rehabilitation which excludes its far deeper emotional significance, namely, revenge, that is counter aggression.

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* This note, which has been translated by Dr. T. James, is intended as a slightly delayed tribute on the occasion of the 10th anniversary of Dr. Reiwald's death.

Just as the neurotic clings to his symptoms, so society cannot dispense with crime and the criminal. "Society has its criminals because it wants them; it wants them because it requires them for the satisfaction of its psychic needs."

Similar to society's fixation on the criminal, Reiwald describes other mass phenomena, recognisable by their cliché-ridden veneer, for example, in success percentages, in statistics and in the law.

It is not surprising that so direct and discomforting a critic created many enemies and gave rise to biting criticisms. In this Reiwald had something in common with Freud, of whom he was a great admirer and to whom he always felt a deep debt although he did not follow him in all detail.

His work will continue to have a considerable influence in the future.

REPORT OF THE ROYAL COMMISSION ON THE POLICE, 1962 *

C. H. Rolph

It is said that a man to whom all the policemen look alarmingly young is a man who has reached the age of fifty and stopped counting. (Currently, this may not be quite true: the "wastage" among disenchanted recruits is keeping up a steady flow of new police faces.) But the members of the Royal Commission on the Police had an average age of about fifty, and yet they seem to have reached the conclusion that the police forces of Great Britain look reassuringly middle-aged, staid, dependable and deliberate. They deferred, that is to say, to the claims of sentiment and tradition epitomised in the local policeman, the man known to the villagers as "Mr. Brown" and to the squire as "Ah, Brown." All the Commissioners—even Dr. A. L. Goodhart—rejected the idea of a national police force, though Dr. Goodhart was unimpressed by the majority view that "the public" would not tolerate it. "I believe," he wrote in his Memorandum of Dissent, "that the history of the Metropolitan Police and of the inspectors of constabulary illustrates how uncertain is an argument based on a prophecy of what the public will or will not accept." It is indeed almost certain that the public would rapidly forget what had happened if, having "nationalised" the police, we continued to use geographical names for its local units; they will not realise what has happened

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* H.M.S.O., Cmnd. 1728, 12s. 6d.

to the British Army so long as we go on referring to the Gloucesters and the King's Own Yorkshire Light Infantry. But the Commissioners did not find that parochial policing was to blame for the rise in crime, or that it was "constitutionally improper," or that it was likely to fall down "during the next few decades" (para. 22). So, for the next few decades, we shall be tackling nation-wide crime and road traffic problems with localised forces and even, perhaps, continuing the present pattern by which we ensure that the districts with the most difficult policing problems shall have the fewest policemen. If Dr. Goodhart had his way there would be a "Royal English and Welsh Police" and a "Royal Scottish Police." There would also survive, as oddly as the duck-billed platypus, a City of London Police, "because its functions are unlike those of any other police force." (Are they? I wonder what Dr. Goodhart thinks that busy little force does?) The Metropolitan Police would be incorporated as part of the Royal English and Welsh, and administered as "one or more" of fifteen regional police units. Each of these fifteen units would have its own Commissioner and its own regional council on estimates and senior promotions, meeting bi-monthly and maintaining a legal department to handle prosecutions and deal with complaints against policemen. The memorandum in which Dr. Goodhart presents these ideas, a brilliantly argued document, has stolen the show. Rumour, hard at work since the Report was published, says that Dr. Goodhart's piece came as a shock to the other Commissioners and might, if only they could have seen it earlier, have dissuaded some of them from signing the majority report without drastically amending it. But without the majority report to demolish, Dr. Goodhart could hardly have produced anything so hard-hitting or perhaps so cogent. Destroying in order to build, his Memorandum is far more than an expression of dissent—it is a clear-sighted synopsis of what another Royal Commission will (at the present speed of events) have to recommend in about thirty years' time.

Surprisingly little attention has been given to the separate recommendation made by Lord Geddes, Sir George Turner and Mr. Alastair Hetherington, that detectives should be much more numerous, much better paid, *and* equipped with the *savoir faire* that results from a more liberal education. They have in mind boys with G.C.E. "A level" passes, and science graduates. They would like to see these comprising half the strength of every C.I.D. They may not live to see it, but something like it will have to come. They reject, for realistic reasons, the notion that this would "create antagonisms which do not exist." They recognise, as their colleagues do not, that antagonism between uniformed and C.I.D. men exists already; and since they doubt whether the presence of a *corps d'élite* is necessarily a bad thing, they are able to contemplate without dismay the creation of a further such corps within it.

Lord Geddes and Mr. Hetherington then join Mr. Leslie Hale, M.P., in a further minority proposal. This commends the Whyatt Report, published by

Justice in December last year, and urges (in crisp, almost cablegram language) the appointment of a Commissioner of Rights, who would in fact be an Ombudsman to receive complaints about the police from "members of the public, M.P.s and others." Since this was the problem which, essentially, brought the Royal Commission to birth, it too might have been expected to excite more attention. It will surely play a prominent part in any Parliamentary debates on the Commissioners' proposals. The Report itself, incidentally one of the best-written blue books to have appeared for many years, is politically an ultra-cautious essay in the art of the possible.

INTERNATIONAL COLLOQUIUM ON NEW PSYCHOLOGICAL METHODS FOR THE TREATMENT OF PRISONERS. INTERNATIONAL PENAL AND PENITENTIARY FOUNDATION

Brussels, March 1962

PAUL DE BERKER

THE Colloquium had for its theme methods of group counselling and group psychotherapy. The majority of the papers and the greater part of the discussion dealt with group counselling.

An international gathering composed of jurists, prison administrators and also various specialists who work face to face with prisoners produces divergent attitudes as well as a medley of ideas. The Anglo-Saxon contingent contained a high proportion of those who worked face to face with prisoners and contributed the majority of the papers. It was preoccupied with pragmatic issues—how does counselling work?—what actually happens in a session?—in a staff meeting?—and so on. The Latin members—who were predominantly prison administrators or jurists, strove to define the basic principles—what is counselling?—what is group psychotherapy?—what are the differences? Each contingent bore tolerantly with the other and the resulting reports, produced with great labour at the end of the Colloquium, show a blend which, while perhaps not being wholly acceptable to either side, at least represents a series of workable statements.

The Colloquium opened with a ground plan for group counselling offered by Norman Fenton (U.S.A.). He defined his group as approximately eight inmate members with one or perhaps two staff members, meeting regularly in the institution and free within wide, although not absolute limits, to discuss what it wished and with a guarantee that its transactions would be regarded as secret or "confidential." In his description the counselling group appeared as a self-contained entity, its members intent upon helping each other with their problems, whatever form these might take. It was also an educative group in so far as it might debate fixed topics either of its own or of the administration's choice. Although the group met within the institution, its transactions had little overflow into institutional life. Indeed Fenton's doctrine of " confidentiality " ensured this.

The Colloquium constantly referred back to Fenton for a definitive ruling as to how groups work and much of what he said in this area was confirmed by other speakers—Sturup (Denmark), de Berker (U.K.), Elias (U.S.A.), Larsson (Sweden). They, however, introduced a new theme, namely the effect that group work has upon the staff and the institution in which it occurs. It became apparent that in their view group counselling was primarily a process of communication from which other major effects flowed. Group counselling was the arena in which the egocentricity and amorality of the prisoner came under scrutiny together with the rigidities, self contradictions and often absurdities of officialdom. In between lay the common humanity of both sides.

It was apparent that many delegates were attracted by the immense potentialities that the proposals offered and yet doubted whether their respective penal systems could adapt to the changes that counselling might entail. They were encouraged, however, when the Chairman of the U.K. Prison Commission produced the newly formulated policy statement which indicated the Commissioners' acceptance of group counselling as a major penal process and their intention to introduce it gradually but in a comprehensive way in more of their institutions.

For the last two days the Colloquium divided itself into working parties, the first of which had to consider " definitions of methods of group treatment." This party was preoccupied with an appropriate translation of the term " group counselling "—should it be called *conseil de groupe* or *entretien de groupe?*—and the nuances of either term, with a predilection for the latter, were debated. The differences between group psychotherapy—mainly as defined in the paper of Colin (France)—and group counselling were examined largely in terms of depth and also in the levels of training appropriate to each activity; fully-trained psychiatrists and psychologists for group therapy; less qualified but technically experienced staff for counselling. The recommendations of this section were of necessity in general terms but they ended with a plea that the growth of group counselling should be guided by experts who would ensure that it did not depart from its original purposes and become the instrument of " the paternalism of the penitentiary régime."

The second working party dealt largely with the selection and training of staff for group counselling. It emphasised that on the whole these were best drawn from inside the institution in which counselling took place and that the role of the visiting counsellor was limited. It was felt that training should be thorough on the theoretical side but concentrate on practical experience of group life. It emphasised that all the staff of an institution—whether or not all practised counselling, should have some training in its implications, since it was accepted that counselling can have profound effects upon the life of the institution and all staff must be aware of this to a greater or lesser degree.

The third working party dealt with " the choice of prisoners for counselling and the integration of group methods with the life of the institution." It was felt that since no scientific methods of selection existed at the moment, on the whole a heterogeneous inmate group offered the best opportunities for spontaneous group life. The inmates should be under no compulsion to participate and the group should work towards an understanding as to how information divulged in the group should be used. The counsellor had loyalty both to his group and the institution, and the group should gradually come to understand this. It was recognised that the counsellor should be a member of a staff group which should offer him the same facilities for free communication and support as the prisoner had in his group.

The working party concluded with a statement that movement towards a therapeutic community should be the aim of penitentiary establishments and that this conviction underlay the majority of conclusions that the party advanced.

THE UNITED NATIONS ASIA AND FAR EAST INSTITUTE FOR THE PREVENTION OF CRIME AND TREATMENT OF OFFENDERS

THE Economic and Social Council of the United Nations accepted a few years ago a resolution of the First Asian Seminar on the Prevention of Crime and the Treatment of Offenders to organise a Training and Research Institute in Social Defence in that region. The Japanese Government offered to be the host country for such a project, and the Institute came into being in summer 1962. Its first Director is Professor Norval Morris, formerly Dean of the University of Adelaide Law School and Visiting Professor at the Harvard Law School, widely known as the author of *The Habitual Criminal* (1951) and a former graduate student of the London School of Economics. His Deputy is Mr. Taro Ogawa, and the address of the new Institute is 26–1 Harumicho, Fuchu, Tokyo.

The Institute is established under a treaty between the United Nations and the Government of Japan, and the buildings include residential facilities for twenty-six trainees as well as classroom and library accommodation. The first international course at the Institute started on the first of September 1962, drawing together 19 trainees from eleven countries in the region. All trainees are senior government officials actively dealing with problems of the prevention and treatment of crime in their own countries. The staff of the Institute consists of three technical assistance experts appointed by the United Nations Technical Assistance Board and seven Japanese criminologists, together with an adequate supporting administrative and domestic staff. The United Nations will also send short-term experts to assist with each training course.

Courses at the Institute are organized as seminars with the experience and existing training of the "students" being utilized as a significant part of the training programme. The courses include field work in various institutes and agencies in Japan. The language of the Institute is English, and simultaneous interpreting facilities are provided. Courses will vary in length from one to six months depending on the level of seniority of trainees.

Trainees are at present supported at the Institute from two sources: United Nations fellowships and funds made available by the Government of Japan. It is hoped to supplement this fellowship programme through Colombo Plan funds and through the assistance of the United Nations Agency for International Development.

The first course has been held from the beginning of September through December of 1962. In 1963, three courses are planned—of one month, six months and three months duration respectively.

The Institute has four broad functions:

(1) training courses;
(2) the dissemination of information on correctional practices throughout the ECAFE region;
(3) research, with particular reference to problems of the region; and
(4) advisory services to governments.

Research projects are currently planned on two topics. The details of these projects will be settled in 1962, and it is hoped to start them early in 1963. One will deal with an assessment of the effects of industrial and economic development in certain Asian urban areas on the incidence of juvenile delinquency. The other will relate to the role of the open institute in programmes of rural redevelopment in the region.

H. M.

A NEW DEPARTMENT OF CRIMINOLOGY

A NEW Department of Criminology has been established by the University of Montreal, with the sociologist, Dr. Denis Szabo, as Director. Among the members of the staff are the psychiatrists, Dr. Henri Ellenberger and Dr. Bruno Cormier. The degree of B.SC. or its equivalent is required for admission to the courses which extend over two academic years. The programme is very comprehensive and includes, among others, courses on research methods and techniques, on the history of criminology, and on "criminalistique."

H. M.

QUEBEC CORRECTIONS SOCIETY

Third Research Conference on Criminology and Delinquency
Montreal, November 20–24, 1962

The Quebec Corrections Society takes pleasure in announcing that the Third Research Conference on Criminology and Delinquency will take place under its general auspices at the University of Montreal, from November 20–24, 1962.

The Forensic Clinic, Department of Psychiatry, McGill University, has assumed responsibility for organising the programme. The purpose of the conference is to give an opportunity for all those working in the field to inform themselves on on-going research and to participate in the discussions.

Responsible for some of the sessions are:

The Toronto Forensic Clinic, directed by Dr. R. E. Turner

This clinic, the first of its kind in Canada, was established in 1956. Though its primary aim was the treatment of sex offenders, and this is still a major preoccupation, their field has widened to include treatment of other offenders, teaching and research. The clinic is affiliated to the Toronto Psychiatric Hospital, a teaching hospital of the University of Toronto.

Department of Criminology of the University of Montreal, directed by Dr. Denis Szabo

This is the first department of criminology of its kind in Canada, and gives courses leading to a Master's degree in criminology. The programme is adapted to the needs of various professionals working in the field of the criminal sciences. (See preceding Note.)

Department of Psychology, University of Montreal, and the *Centre de Recherches en Relations Humaines, directed by Fr. Noel Mailloux,* O.P.

Father Mailloux has made important contributions to the understanding of delinquency, especially in regard to juvenile offenders. He and his assistants have established a school for the training of educators specialising in the re-education of delinquent youth.

Research Group in Forensic Psychiatry of McGill University, directed by Dr. B. M. Cormier

This group is carrying on a long-term investigation of the psychiatric aspects of criminality. This is a clinical research, whose aim is to provide for professionals working in the field a sound clinical basis for the understanding of criminality in the adult offender and for treatment. The research has been carried on at St. Vincent de Paul Penitentiary, and in the community, through the co-operation of judges and after-care agencies who have referred cases.

Also from McGill University, Dr. N. B. Epstein and Dr. W. A. Westley will contribute to a symposium on the family.

All requests for information about this conference should be addressed to: Dr. Bruno M. Cormier, Third Research Conference on Criminology and Delinquency, 509 Pine Avenue West, Montreal 18, Quebec.

"SOVETSKAYA ZAKONNOST" (Soviet Legality) No. 12, 1961

R. BEERMANN

SOVETSKAYA ZAKONNOST is the journal of the Procuracy of the USSR. It is rather an important publication, because the Procuracy in the USSR fulfils not merely the functions of state attorneys and prosecuting counsel; their principal function is that of guardians and representatives of legality as such. Even in a criminal trial, where their function is prima facie that of counsel for the prosecution, they have to maintain a degree of impartiality and to be " the speaking judge" (an expression used by A. F. Koni, probably the most prominent Russian lawyer of the turn of the century), while facing " the trial judge."

In this respect, the issue under review is particularly interesting because, in its leader and first article, it mentions the deviations from that principle during the Stalin and Vishynski era. To the latter are ascribed such pronouncements as: "The socialist legal consciousness plays an important part in reconciling the contradictions between the law and the demands of life" and: "The offender has to be judged in the light of the overall interests of the building of socialism" (page 12). Both articles deal with past and present shortcomings in the practice of a number of officials of the Procuracy. They demand a closer contact with the public and a stricter adherence to the law, as well as a thorough study of the causes and conditions conducive to crime.

A statement on page 29 is of particular interest: " Abuses of power must be suppressed and severely punished regardless of the position of the persons involved." The article in which this occurs is written by the procurator of the investigation department of the Procuracy of the USSR. He alleges gross abuses by some persons of their managerial or executive positions, while the local officers of the Procuracy remained inactive or took only insufficient and inept steps, instead of suppressing the abuses and prosecuting the offenders. A number of cases of gross misappropriation and false balance sheets are mentioned in the article, particularly in the Eastern Union Republics.

L. Urakov, the procurator of the Moscow *oblast* (region) deals with "the legal responsibility (of persons) for private entrepreneurships" p. 21). He writes about the application of the law of the 4th May, 1961 (RSFSR Union Republic) directed towards "strengthening the struggle against persons who avoid doing socially useful work and lead an anti-social parasitic way of life" (the parasite law). L. Urakov stresses the fact that among idlers are many who are engaged in private entrepreneurships and in that way draw an unearned income. A number of instances are mentioned where such persons were tried either before the general meetings of the public or the courts and were sentenced to terms of exile. The article gives an insight into the means employed by these entrepreneurs. According to Urakov, these include bribery, misappropriation of state property, the camouflaging of activities as agent or employee of a kolkhos farm or state enterprise, and the use of private property for the purpose of "obtaining an unearned income." The article deplores the fact that some managers and accountants of kolkhos farms are supporting the activities of such private entrepreneurs, under the pretext that it is only due to the activities of such entrepreneurs that the kolkhos farm has made a profit. These leaders, writes Urakov, do not consider the moral corruption that is involved in such activities and the material harm suffered by the economy in general.

An interesting article is contributed by S. Mitrovich, Doctor of Law, on "the tasks of forensic laboratories in the prevention of crime." The main theme of the article is that there has so far been insufficient attention paid to this role of forensic laboratories, which, by summarising and generalising the experiences gained, are well suited to play an important part in the prevention of crime. There have already been important developments due to the work of these laboratories in the prevention of traffic accidents, and also in the struggle against misappropriations of state property. Amassing a considerable amount of documentary data, the central organisation of forensic laboratories is able to point to deficiencies in accounting and auditing practices in state enterprises. The organisation of state forensic laboratories was an extremely important and salutary step. Beside their functions in crime detection and important research work, they also supply the courts, when necessary, with competent expert witnesses well suited to dealing with problems of a forensic character.

Under the section on new legal enactments of Ministries and Departments of the USSR and the Union Republics is mentioned a new law of the RSFSR, of 5th October, 1961, which decrees that drivers of public transport vehicles found drunk while driving shall lose their licences for one year, if no other offences are also committed involving a more severe punishment. If the offence is repeated within three years, the licence will then be withdrawn for three years.

The prevention of child neglect is the aim of an order of the Presidium of the Supreme Soviet of the RSFSR to the Soviets of Workers' Deputies of the Volgograd (former Stalingrad) *oblast.* In this *oblast* the number of unsupervised and neglected children has not decreased since 1959. Deficiencies are noted in providing employment for 15- and 16-year old adolescents. The Volgograd Executive Committees and Soviets are ordered to work out and to implement measures necessary to prevent the neglect of children and adolescents.

The last two sections of the journal deal with reports of cases before the Supreme Courts of the USSR or the Union Republics or the State Arbitration —a department attached to the Council of Ministers of the USSR dealing with legal disputes between state enterprises.

EXECUTIONS IN THE UNITED STATES 1961 *

TERENCE MORRIS

NATIONAL Prisoner Statistics just issued by the United States Department of Justice show that in 1961 the figure for civil executions was the lowest on record since 1930 when statistics were first collected by the Federal Bureau of Prisons. In 1961 twenty whites and twenty-two negroes were executed compared with the 1930 figure of ninety whites and sixty-five negroes. The peak figure of the period was in 1935 when 199 persons, of whom seventy-seven were negroes, suffered the capital penalty. In all states which have retained the death penalty since 1930 the average annual figure of executions has fallen since 1954—in the north-eastern states from twenty-five a year to two, and in the southern states where death is the penalty for rape, from an average of twenty-four a year to eleven. 89·8 per cent. of men executed for rape in 1961 were negroes.

California, which has the reputation of the most advanced penal system in the U.S., paradoxically headed the execution league in 1961 with eight executions by lethal gas, followed by South Carolina and Mississippi with five each, Virginia with four and Georgia and Texas with three each. These six states accounted for two-thirds of the national total. Although the average time between sentence and actual execution was sixteen months, one murderer in Mississippi had been waiting six years, five months and thirteen days for his seat in the electric chair. No woman has suffered the death penalty in the United States since 1957.

Since 1930 the Army and the Air Force have carried out 160 death sentences, twenty-one of them since 1950. Of these 160 executions, 106 were for murder (including twenty-one involving rape), fifty-three for rape alone, and one, that of Private Eddie Slovik, for desertion. The United States Navy carried out its last execution in 1849.

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* U.S. Department of Justice. Bureau of Prisons. National Prisoner Statistics No. 28. April 1962. *Executions 1961.*

BOOKS AND PERIODICALS

CRITICAL NOTICE

IN SEARCH OF CRIMINOLOGY. By LEON RADZINOWICZ. [London: Heinemann, 1961, vii and 254 pp., 25s. Cambridge, Mass.: Harvard University Press, 1962, $4.75).

SENSIBLY enough, the author who, some three or four years ago, was entrusted with the important task of expanding the existing Department of Criminal Science of Cambridge University into an Institute of Criminology thought it advisable to embark on a "Grand Tour" and collect some first-hand information "on contemporary standards in teaching and research" in criminology on the European Continent and U.S.A. The results are presented in this volume, which is as far as can be ascertained the first criminological book published by the author, whose work has hitherto been mainly devoted to his well-known *History of English Criminal Law* and the editing of the *Cambridge Studies in Criminal Science* (now *Cambridge Studies in Criminology*). The European countries visited were Italy, France, Belgium, Holland, Western Germany, Austria, Norway and Denmark. Sweden and Switzerland were, for no apparent reason, omitted, and it is also a pity that the author did not visit his native Poland, a country where some criminological research has been done after the war [1] and on which his first-hand observations might have been particularly interesting. No indication is given in the book of how much time was actually spent in each of the countries visited, which makes it somewhat difficult to form an opinion on the accuracy of the author's statements. This is all the more regrettable as at least from one of these countries, the United States, the complaint has already been made by a (on the whole not unsympathetic) reviewer, Professor Gerhard O. W. Mueller of New York University: "I wonder whether a brief visit, with a few interviews and a few random inspections, can be expected to yield an accurate account of the dynamic criminology of the world's most dynamic continent, or even of smaller countries in other continents." [2]

With these two reservations concerning the exclusion of certain important countries and possible shortage of time allotted to observation, the plan of this "Grand Tour" was admirable, but the manner in which the programme was carried through leaves much to be desired. As usual, the author is at his best on the historical side. The sketches he provides on the criminological developments in the nineteenth and early twentieth centuries in the countries visited are informative and, with the exceptions to be mentioned at once, on the whole accurate. But to collect and present this historical material no such round the world trip would have been required—the Cambridge and Oxford Libraries, the British Museum, the British Library of Political and Economic Science (L.S.E.), and so on might have been adequate for the purpose. We are chiefly interested, however, in the present state of affairs seen in the light of immediately preceding developments and expect to be given exact information on the essential aspects of criminological teaching and research in those countries. How far this study meets our requirements will be shown below.

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[1] *Brit. J. Criminol.* 3, 90.

[2] *New York University Law Review*, April 1962, pp. 348 *et seq.*

In a review in one of the London Sunday papers the book was called a *Baedeker*, and in a way this may be an apt description, but one of the great merits of Baedeker is its factual accuracy, and as already indicated this volume contains a number of inaccuracies, major and minor ones, which detract from its value as a reliable guide book. To give a few examples first of what may be regarded as minor inaccuracies, the author is occasionally rather careless with names and even with the identity of persons. On p. 61 there is a reference to "von Oettingen and von Mayer who laid the foundation for the effective use and interpretation of criminal statistics." This is obviously meant as a reference to the great nineteenth-century social statistician Georg von Mayr who is, however, almost inextricably mixed up in this book with the present professor of criminal law at Kiel University, Hellmuth Mayer. The latter, correctly named on p. 188, is given a gratuitous "von" in the Index, which contains no reference at all to Georg von Mayr. While in this case two entirely different figures have been rolled into one, the opposite has happened to the eminent nineteenth-century French criminologist, anthropologist and professor of forensic medicine at Lyons, Jean Alexandre Eugène Lacassagne, generally known as "A. Lacassagne," born in 1843 and famous as one of the most formidable opponents of Lombroso as well as through his slogan of "society gets the criminals which it deserves" (perhaps equally true of criminologists, one might add).[3] On p. 65 of the present book he is referred to as "H. Lacassagne," on p. 210 correctly as "A. Lacassagne," and the Index lists both, A. and H. separately, so that we are given the impression that two criminologists of this surname are involved. The year of the first publication of Lacassagne's *Archives d'Anthropologie Criminelle*, which he founded jointly with Tarde, is wrongly given on p. 65 as 1836 (before his birth), instead of 1886. The nineteenth-century German prison administrator Eugen von Jagemann is referred to on p. 41 as "Eugène de Jagemann," as if he had been French.

Far more important and irritating are certain inaccuracies and gaps concerning the contemporary scene. In his lengthy American chapter, aptly called "A Vast Laboratory," the author complains that "towards the study of criminology as such the schools of law all maintain an identical aloofness; in none is criminology taught, even as a brief optional course of lectures. Nor is there any reasonable ground for supposing that this attitude will alter in the foreseeable future" (p. 162). He is profoundly alarmed by the discovery that the study of criminology in the United States "should be confined almost entirely to the departments of sociology and be so completely excluded from the legal curriculum" and he makes, among other proposals, the suggestion that there should be "a selective, well thought out postgraduate course" (p. 163). We should expect the American Law Schools to be deeply grateful to our author for his valuable interest in their reform; instead we read the following comment by one of their spokesmen: "The author simply did not look for the facts . . . at New York University School of Law alone, of eighteen different courses and seminars in criminal law administration and criminological subjects, seven are distinctly criminological in compass . . . several other schools of law do offer some instruction in criminology" (Gerhard Mueller, *loc. cit.*). It is of course common knowledge that the departments of sociology have been for many years the real home of the teaching of criminology in the United States, and it is also true that in the UNESCO Report of 1957 the American chapter offers no information on any work done in this field by the law schools. However, the position may have changed in recent years, and a categorical statement such as that by Professor Mueller is difficult to reconcile with the picture presented by the author. Moreover, in another chapter (p. 171) the book contains an equally sweeping statement (on the same subject of the criminological training for lawyers) which is so obviously wrong that it makes the reader somewhat suspicious of the accuracy of what he writes about the attitude of the American law schools. The statement we have in mind refers to England. As it was the object of the author to present a picture of the position abroad he could hardly have been blamed if he had altogether ignored this country. What he has done, however, is neither here nor there. He has produced a few pages which are significant more for what they omit than for what they contain (pp. 171 et seq.), and the volume should have been more appropriately called *In Search of Criminology outside Britain.* On p. 171 the author mentions several Continental law faculties as providing "opportunities, at present non-existing in England, to acquire criminological knowledge" for students of law. Has the author never heard of the flourishing inter-collegiate criminology course which has for nearly fifteen years, since 1948, been a regular feature of the syllabus for the LL.M. (Master of Laws) curriculum of London University, held at the University Institute of Advanced Legal Studies? Many hundreds of lawyers from this country, the Commonwealth and the Colonies have received their criminological training in this course. It would have been easy for the author to obtain this information from the present reviewer's account in the UNESCO Report already referred to (p. 126 of the Report), and in the light of this striking gap in the author's narrative relating to the position in his own country we find it not particularly difficult to accept Professor Mueller's criticism concerning the author's description of the position in the U.S.A. Equally surprising is the fact that in those few pages on Britain neither the I.S.T.D. with its many criminological courses nor the Scientific Group for the Discussion of Delinquency Problems (now the British Society of Criminology) nor this Journal are mentioned at all. Utterly inadequate, too, is the account of post-war developments in criminological research in this country. In short, if the author did not intend to provide a complete and balanced picture he should have altogether refrained from dealing with Britain. The same applies to the British Commonwealth, which receives a bare six lines to inform the reader about the progress made since the war especially at the Universities of Melbourne, Toronto and Montreal.

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[3] A good picture of Lacassagne's personality and work has recently been given by various authors, in "*Examen de Personnalité en Criminologie*," Premier Congrès Français de Criminologie, Lyon, Octobre 21–24, 1960, Tome 11 (Masson & Co., Paris 1961).

Apart from these gaps and misstatements, the account of the teaching and research work at present done in U.S.A. and the other countries visited is reasonably detailed and informative. To expect it to be complete and entirely up to date would not be fair in view of the constantly changing picture and the enormous quantity of criminological writing and research coming in particular from the U.S.A. Indeed the author is very critical of the, in his opinion, quite excessive output emanating from that country; about two-thirds of it is, he thinks, rather unnecessary (p. 121). He admits that his estimate and the selection he would make of what is worth publishing can be only subjective, "not lending itself to precise and reasoned comparison with any guesses that others may make." The present reviewer agrees that too much material of inferior quality is published in the U.S.A., but what the author does not seem to appreciate is that in a vast country with so many academic courses in criminology—a feature of which he does not disapprove—there must perforce be very many teachers of this discipline who, in order to gain recognition and promotion, are compelled to do research and see to it that its results are duly published. It is the highly unenviable task of the professional journals to stem the flood by mercilessly rejecting everything second- or third-rate, but here as in so many other fields of human endeavour it is not the extremes, the very good and very bad, but the borderline cases that present the real difficulties. Moreover, to make the right selection one needs a firm standard of values regarding problems that are worth studying and research techniques that should be applied. The author makes no serious attempt to provide such standards; his main concern seems to be that there should be an ample supply of funds for teaching and research, and he criticises the Federal and State Governments and municipalities for failing to provide them: "A situation in which research into a problem of national importance is almost entirely left to private enterprise cannot, in the long run, be regarded as completely satisfactory" (p. 130). Here the author touches the very delicate and complex problem of how public and private efforts could best be distributed and combined in this field, but he offers no solution, and American readers might possibly be tempted to inquire whether "private enterprise" and its financial support do not play a very important role in other parts of the world, too, in providing funds for research and the establishment of criminological institutes.

Subjectivity of selection—a fault to which the author pleads guilty—is inevitable, but it can be overdone, and here, we feel, it has been overdone. No reader of this book who is not already familiar with the modern literature on the subject would be able to find out from the author's narrative who are the leading figures in criminological research in U.S.A. and in some of the Continental countries visited. There are only the scantiest references to the work of Sutherland, Sellin and the Gluecks. Once more, I might leave it to Professor Mueller to pass judgment: "Where," he writes, "is the account of the most elaborate study of them all, the Glueck prediction study? . . . a brief reference to only one thirty-two-year-old volume of the many Glueck publications is hardly an adequate recognition. . . . Although mentioned or listed elsewhere, the Glueck studies have been treated with rather icy silence throughout." It might be pleaded in defence of the author that the work of these eminent scholars is already too generally known to need any further mention, but as any reasonable programme and planning of research requires continuity at least over a period of a few decades it would have been essential for the understanding of the present American scene to find out whether the work so fruitfully initiated by those leading figures is still being carried on by them or by others. What, *e.g.*, is the current position of prediction studies in U.S.A. as seen by an outsider? How far have the tables worked out by the Gluecks been validated, and how do the results compare with the prediction work done in this country? What has been, after Edwin H. Sutherland's death, the fate of his studies on white collar crime—surely one of the most striking and meaningful discoveries of modern criminology? Is there any further field work in progress on this most important topic? Has Thorsten Sellin been able to continue his investigations on criminal statistics (see, *e.g.*, the brief advance notice in *Brit. J. Criminol.* **1**, 167)? Are there any cross-cultural studies in progress of the kind recommended by Marshall B. Clinard in this Journal (*Brit. J. Delinq.* **7**, 110 *et seq.*)?

With regard to some of the Continental countries, too, we find that their stories are told in the fashion of "Hamlet without the Prince." There is no appreciation whatsoever of the highly influential work done by Etienne de Greeff and Paul Cornil in Belgium, by Olof Kinberg in the Scandinavian countries, by Ernst Kretschmer in Germany (the latter is nowhere mentioned). Nor are we given any information on the activities of such international bodies as the International Society of Criminology and the International Society of Social Defence, which after all have their headquarters and their main following in the countries visited and the first of which plays an important part in the international teaching of criminology. The atmosphere created by these men and movements is possibly more significant for the future of criminology than the mere size of budgets and the number of lectures so meticulously compared in this book. And was it really necessary to tell Hans von Hentig that, while residing in the United States, he "could not resist the temptation to add his contribution to this library of textbooks"—meaning the, in the author's view, already excessive number of American textbooks on the subject—(p. 198), especially bearing in mind that one of these two Hentig volumes, *The Criminal and his Victim*, opened up a new line of criminological thinking, *i.e.*, "Victimology"?

H. M.

REVIEWS

THE JUVENILE COURT IN ISRAEL. By DAVID REIFEN. [Jerusalem: Ministry of Justice. 1962. Obtainable free on application.]

IN about 17,000 words this well produced paperback gives a lucid and interesting account of the working of the juvenile court in Israel.

Separate juvenile courts in the full sense in which we understand them here were established in the law only in 1950. Serving a population of somewhat over two million there are two full-time paid and professional judges working exclusively in the juvenile courts, each sitting alone, and holding sessions all over the country. The author, who is also a trained and experienced social worker, is one of these.

The population of Israel has nearly trebled since 1948. About half now consists of Jews from oriental countries whose way of life, especially as regards relationships within the family, is disorganised by the impact with the competitive, industrialised and urbanised Western world. In this situaton Judge Reifen sees the immense importance of the contribution which the juvenile court can make as a socialising and educative force. Firmly grounded in fundamental legal principles the court takes every opportunity in carrying out its duties to do so in a way which contributes to—instead of conflicting with—this overall therapeutic intention.

The English juvenile court has, quite clearly, served as the prototype and this makes the points of difference developed out of the practical experience of the last dozen years particularly interesting. There are no lay magistrates. The age of criminal responsibility is nine. The upper age limit is sixteen for boys but eighteen for girls. Privacy is far more scrupulously observed than in urban courts here, there being in all no more than four or five people in the room besides the offender and his parents plus occasionally a Press representative. The judge himself explains to the defendant how he is thought to have offended and asks him to tell the court what happened. This is usually all that is necessary as 80 per cent. plead guilty, but if material points are in doubt evidence is heard in the usual way. Probation orders can be made without proceeding to conviction. Offenders are usually bailed whilst pre-sentence reports are obtained. Since 1958 reports are no longer documents of evidence but are confidential and for the guidance of the court only at its own discretion. The judge must record his reasons for both the verdict and the choice of sentence.

The probation service is employed not by the Ministry of Justice but the Ministry of Social Welfare. The officers are trained social workers and full use is made of this advantage, *e.g.*, conditions are not embodied as requirements in a probation order except on the officer's application. There is no probation without previous report, since factors otherwise known to the court cannot be a sufficient guide. Since experience has shown that some girls respond better to male officers the actual supervision of such cases is done by male probation officers.

Institutional placement for educational treatment is the job of the Youth Authority which works within the Ministry of Social Welfare but with a public advisory Committee. But the order is made and the length of sentence fixed by the court and Judge Reifen advances sensible reasons for disliking the principle of an indeterminate sentence. He has doubts also about the usefulness of the suspended sentences which, since 1954, have been available to the court and which have not, in fact, proved popular.

In care or protection cases it is only necessary to prove *either*, for example, refractoriness or moral danger, etc., *or* lack of suitable guardianship, and not both. But perhaps the most interesting innovation came in 1955 with the use of Youth Interrogators to obtain the evidence of under-fourteens involved in sexual cases. These are trained professional social workers, psychologists or psychiatrists used to interviewing individual children and especially appointed for the specific purpose. This evidence is admissible in court but if called by the prosecution it must be corroborated before a conviction can be obtained.

Of special note is the experimental voluntary "Youth for Youth" service under which secondary school children help in the struggle against delinquency by acting as play supervisors, tutors and general helpers with various social agencies and are credibly stated to be especially acceptable to the families concerned.

Reading this well-written account one receives a vivid impression of the common sense and courage which have led to such a rational use of the juvenile court and which are enabling it so admirably to fulfil its social purpose. The divergences from our well-worn practices and procedures should be particularly noted. Most of them seem to work well.

W. E. Cavenagh

THE COURAGE OF HIS CONVICTIONS. By TONY PARKER and ROBERT ALLERTON.
[London: Hutchinson. 1962. 191 pp. 16s.]

THIS is the record of taped conversations between Tony Parker, ex-prison-visitor, early thirties, and "Robert Allerton," ex-prisoner, ditto. Parker asks the questions and Allerton often answers.

What emerges is the story of Allerton's life, as he sees it and a little as he would like us to see it. This is not to say that interviewer and interviewee are not sincere. On the contrary, there is a quality of candour in this book which adds to its value as well as to its already considerable readableness. But one sometimes senses that the views expressed are views acceptable to fellow criminals and that the need to conform to their standards may sometimes get in the way of self-revelation, much as conventional attitudes may sometimes blur the self of ordinary men.

Allerton was born in a poor neighbourhood. His childhood was spent amongst friends and relations many of whom were criminals. A notable exception was his father, and the opening lines of Chapter I give a clue that Allerton's criminality was not mere conformity to a delinquent sub-culture: "The funny thing is, my father was straight. Sometimes I think if he hadn't been I mightn't have taken to crime." But poverty, economic and cultural, maimed him and most of those around him. From this, as well as perhaps from other things, he wanted to escape. Having been a rebel, as long as he remembers, crime seemed the natural and the most satisfying way out. For there is little doubt that it was not just money that attracted him. Crime as a way of life, the exultation of fighting authority, the fun of hunting the mugs, the freedom of being beholden to no man, those are things he valued. Approved school, borstal or prison merely mean that physical freedom is curtailed. Allerton is prepared to spend a third of his life in prison so as to have freedom of the spirit, freedom to do as he pleases, without thought for others.

Beloved anarchy, the candour of "I am as I am," pride at being good at being bad (attributes he shares faintly with, for example, Brigitte Bardot), this is the face that Allerton shows us. But there are chinks in his armour. Kindness is the great enemy—personal ties. It is less dangerous to have a different girl every night than to love and be loved. But affection has broken in before; it may again. Then, too, he is something of an intellectual; he seems to feel some kinship with such non-wide boys. His condemnation of pimps is conventional in the best criminal circles (as well as amongst the most upright mugs). But what about his admiration for Danilo Dolci? True, Dolci is often agin the Government, therefore admirable. But he is also for others, not just for himself, and therefore unfree, fettered, responsible, muglike.

These are some of the straws in the wind. Pale straws. Faint cracks in the Id. They suggest that Allerton's pursuit of crime may become more troubled as time goes on. Besides, the book is a success—and look what happened to poor "Fings" Norman!

H. J. Klare

GATE FEVER. By JANE BUXTON and MARGARET TURNER. [London: The Cresset Press. 1962. 198 pp. Illus. 21s.]

ILLEGAL demonstrations against the Government's nuclear arms policy have, in the past three years, given an experience of prison life to many people who are both more public-spirited and more articulate than the usual types of prisoner, as did the suffragette movement half a century ago and pacifism during the two world wars. The probable outcome is a spate of prison reforms.

Gate Fever is an alternate series of weekly letters which the two authors "would have liked to have written from Holloway" had it not been for prison censorship. The letters achieve, quite remarkably, the sense of having been written at the time, describing as they do the day-to-day happenings that made up the authors' six months' imprisonment, imposed as a result of their participation in the Foulness demonstration of 1960. The main impression of prison life is one of inefficiency and frustration. There are several references to the difficulty of being expected to do everything at the proper time without the aid of clocks or watches and without adequate information. Trying to deal with some of the authorities is likened to "shovelling fog with a pitchfork."

While some of the prisoners are overworked, there may be insufficient work for others. Knitting serves to keep them occupied, "in case a visitor or Governor comes along." The authors assumed, at first, that the grey knitted squares would be made into blankets for refugees, but found to their horror that the squares were only pulled undone for re-knitting. Apart from the waste of time and energy, this is hardly calculated to develop in the prisoners a good attitude towards the value of work. However, this minor abuse may now have been abolished, for Jane Buxton made an official complaint about it to the Governor, who had not known of it. Most prisoners rarely complain about anything, for fear of losing some of their remission.

Very heavy work is demanded of the women prisoners from time to time, including the lifting of weights that are really too much for them. Slipped discs, abdominal and back strains, and a prolapsed uterus are some of the results mentioned in the book. Two cases are described of sick women being made to carry on with heavy work—and on an inadequate diet. One prisoner had to have an emergency pancreas operation, and the day after getting out of bed was graded Labour I and sent to work in the prison's jam factory. Allowed no medicines of their own, the prisoners have to book to see the doctor even to get an aspirin for a headache—and it might take twelve hours to get it.

More serious complaints are treated with sedatives, without any diagnosis. Emergency bells are often left unanswered.

The food described is not only meagre but also deficient in protein and some vitamins. Most prisoners suffer from anaemia, loss of weight and scaly skin. Hygiene is lacking. Although prisoners working in the kitchens have to dress up in white coats and caps before serving out the food, this is merely an illusion of cleanliness: "Our hands might be filthy; no one bothers about them, but it is a serious offence to forget to dress up for the job." New prisoners may be given soiled underclothes, dirty hair-brushes, and—usually—old, misshapen shoes, that cause painful foot conditions.

One of the worst causes of distress is the regulation prohibiting visits during the first twenty-eight days after conviction—just when one's home affairs need to be settled. The notorious Holloway punishment cells are dreaded. Lesbianism is understandably rife.

But in spite of all the horrors of closed prisons such as Holloway, they are preferred by many prisoners to the "privileged" open prisons, where there is more regimentation and less opportunity for reading, where the "physical freedom only emphasises the more important lack of personal freedom," and where the prisoners are on show on "Open Days" and "are expected to hand out to the visitors dainty teas that they are not allowed to share themselves."

The book has its humorous touches—such as the story of a prisoner whose husband had "done a job" to pay for a good lawyer for her appeal. (Legal Aid is apparently not thought much of!) The traditional idea of imprisonment being the payment of "a debt to society" has permeated to the criminal classes, so that those who lack a personal code of ethics may "look upon their sentence as a straightforward payment in exchange for their ill-gotten gains"—which they therefore have a right to afterwards.

Some of the vagaries of our judicial system are shown up in the book. A woman who had obtained £20 by false pretences had a two-year sentence, as had others who had forged cheques for £1,000 or more. Also, many foreign girls are on remand (which in some ways is worse than being a convicted prisoner) for "nothing worse than overstaying their visa or changing their job without a permit."

The question is asked, why, if prison is designed as a deterrent to crime, so much secrecy surrounds it. Any information officially released to the Press is always considerably softened and the grimmer facts suppressed. As for reforming the criminal: "I think that if I had come in as a criminal, but had subsequently made the decision never to go wrong again, the atmosphere here would more than likely after the first week or two make me say to myself, 'Oh, what the hell.'"

The book appeals for some of the reforms so often recommended by penal reformers—particularly for properly paid work, so that prisoners may pay for their keep, save towards their release, and compensate any victims of their crime. The indeterminate sentence, on the other hand, is described as "the worst punishment anyone can have," since the prisoner has "no known target on which to pin her hopes and nothing to plan for." The authors' opinions on penal reform, however, are less explicit than implicit, in their week-by-week record of prison life. And they admit that their reactions "were probably coloured by our inevitable identification with the prisoners rather than the authorities." But this book, which should become required reading for all concerned with the treatment of offenders, makes any specific proposals for prison reform seem totally inadequate. The whole system needs to be replaced by something more humane and more constructive, that will channel initiative instead of killing it.

There are some effectively grim, claustrophobic drawings by Jane Buxton.

Barbara Smoker

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PRINCIPI DI DIFESA SOCIALE. By FILIPPO GRAMATICA. [Padova, Italy: CEDAM 1961. 367 pp. Lire it. 2,000.]

FILIPPO GRAMATICA, founder and President of the International Social Defence Association, has attempted, in the present book, to systematise the "principles or foundations of the "new" social defence movement. The main point of the principles, as it is well known, is the attempt to eliminate the concept of "penal responsibility" and to substitute instead a somewhat vague "antisociality." The followers of the social defence movement are divided in two main groups: those who advocate a radical change from the traditional criminal law approach, to be discarded in favour of the "new" principles and those who, with more caution, propose a gradual integration of the same principles in the existing system. Obviously, the present trend favours the second group, and some of the "new" principles (such as the examination of the personality of the offender) are no longer so new, even in Italy. However, Gramatica is in favour of a radical change, with the creation of an entirely new "legislative system, in which the State, instead of limiting its actions to punishment of those who violated its will, will help men to overcome the difficulties of modern life." Briefly, the "principles" are the following: (a) an assessment of antisociality should be used instead of criminal responsibility; (b) objective, or presumed, antisociality should be abolished; (c) punishment as such should be abolished and substituted by unified social defence methods; (d) these methods should be indeterminate, in order to be used, in a flexible way, in the course of the execution of sentence, in accordance with a constant reassessment of the personality of the offender; (e) use of the "two phases" system (on fact and on personality of the author) in criminal trials; (f) establishment of a "dossier" of the personality of the offender.

Gramatica, with obvious enthusiasm, minimises the problems which would be created by the full acceptance of these proposals, and does not credit the existing positive legal systems with enough vigour and flexibility for a slower change.

From a criminological point of view, the author rejects the contention that the criminal is a naturalistic category and maintains the impossibility of drawing sharp dividing lines between criminal and non-criminal subjects. Therefore, he prefers to designate the former group as "asociale." He would like to abolish, in the Italian Penal Code, the categories of recidivists, habitual, professional and "by tendency" criminals. In the last section of the book, Gramatica discusses the functional autonomy of social defence, which he would like to separate clearly from criminology, seen as an "auxiliary" science. One reason for the advocated autonomy should be, in his opinion, the fact that social defence aims at the "development of society" (il divenire della società), a very ambitious programme indeed!

Many of the ideas expressed in the book are valuable; much that is presented as new and revolutionary is already part of penal practice in several countries. A criminologist, although sharing most of the ideals of the author, would look for a more pragmatic, realistic and scientific approach.

F. Ferracuti

GRUNDFRAGEN DER STRAFRECHTSREFORM. By KARL PETERS and DIETRICH LANG-HINRICHSEN. [Paderborn, Germany: Verlag Bonifacius-Druckerei, pp. 140. No year and no price.]

THIS small monograph was published under the auspices of the "Arbeitsgemeinschaft Katholisch-sozialer Bildungswerks in der Bundesrepublik Deutschland" (Work Co-operative of the Catholic-Social Education Association of West Germany) and is based on public lectures given to arouse the interest of the public in the reform and revision of the penal code.

It attempts to trace some of the general concepts of the Grosse Strafrechtsreform, including the concept previously discussed in this *Journal* of the French "Défense sociale," which has been moving away from punitive sentences, away from guilt and atonement (*Schuld und Suehne*), and has been trying to establish centres for the resocialisation (*Resozialisierung*) of the offender for the sake of "society" (the authors' concept of "society" is nowhere defined here; but it can be assumed that it is one based on the sociological thinking of Simmel, v. Wiese, *et al.*). Likewise, it is stressed that the social sciences (psychology, criminology, etc.) should be consulted in penal reform, particularly since jurists have been helped considerably by the findings and teachings of criminal anthropology, criminal pathology, psychoanalysis, individual psychology, and others. The co-operation of these disciplines has resulted in an international frame of references, and every newly gained research project has led to new "problem constellations."

The authors touch in every chapter on the negative sides of the "reform," since they are not, and should not be, satisfied with the present gains. For instance, they criticise the failure of the legislature to integrate successfully the three branches of practical psychology into one—namely, the penal law, the penal legal procedure, and the execution of the penal law—a criticism which certainly would hold equally true of other countries, particularly the United States.

The monograph unfortunately lacks an index of subjects and authors, and a bibliography, though copious footnotes are everywhere. These footnotes are, however, hard for the layman to follow, although the monograph was intended for him. Nevertheless, it is a brief but excellent treatise on present-day penal legislation in West Germany.

Hans A. Illing

THE TWENTIETH CENTURY. Winter 1962. Vol. 170, No. 1012. 5s.

THIS edition offers evidence and explanations of "what's wrong with justice, jails, police and crime" in the twentieth century. A large number of one's favourite reformers are contributors, and their variety of approach makes the quarterly lively and very readable.

The opening article by Hugh Klare proves with the aid of statistical findings that crime is largely an activity of the young. Alan Little points out that six out of ten Borstal trainees discharged in 1955 were found guilty of a further offence within three years; also that the success of the Borstal system is declining to the extent that the unreformed prison system is as effective as the reformed Borstal system in preventing recidivism. Terence Morris describes how a discontented, inadequate prison staff copes with the difficulties of preserving good order and discipline. He concludes that in present prevailing prison conditions a prisoner is unlikely to learn new attitudes which are acceptable to society.

Amongst the other contributors I particularly liked "Syllabub"'s "Within the Gates," which describes prison life from the staff side, and "700 to One," where C. H. Rolph puts firmly yet sensitively the viewpoint of policemen. In summary: a bumper crop, well worth harvesting at the price.

Jean Graham Hall

THE HOMOSEXUAL SOCIETY. By RICHARD HAUSER. [London: The Bodley Head. 1962. 167 pp. 18s.]

THIS is an odd book. It can be said at once that it has no scientific value to anyone with any knowledge of the subject. Though the Home Office financed a "survey," which is said to be reported in the text, to a tune of £525, it cannot be said that anything new has been discovered. There is no index. There is not a single reference. Mr. Hauser appears to have begun and completed his study entirely unaware that anyone else had ever studied or written on the subject. Apart from the "data," mainly recorded snippets of conversation, the book consists of *obiter dicta*, unsupported ideas and conclusions. On the credit side it can be said that at least the problem is discussed with compassion.

Stephen Coates

CLINICAL CHILD PSYCHIATRY. By KENNETH SODDY. [London: Baillière Tindall & Cox. 1960. 470 pp. 42s.]

THIS book follows the accepted pattern of child psychiatry since the child guidance movement in taking the child in his setting—family and cultural—as the clinical unit. The longitudinal plan is on a developmental basis—the child in his main instinctual aims, self-supporting, reproductive and social, as they are modified by his setting. Development is followed from conception to adolescence with concurrent description of clinical disturbances at the point of development at which they are deemed to begin. Case records are lavish.

While the general plan is individual rather than universally acceptable, the merit of the book lies in the author's clinical experience and his observations and comments, which are sound and in the main well judged. Those who have been introduced to the subject will find much of value, and the more experienced will find illuminating observations at many points.

Kenneth Cameron

ROLE OF SPEECH IN THE REGULATION OF NORMAL AND ABNORMAL BEHAVIOUR. By A. R. LURIA (Moscow). [London: Pergamon Press. 1961. 100 pp. 50s.]

THIS slender but important volume discusses the author's researches on the relationship between general development and the acquisition of speech in normal and abnormal children. Dr. Luria expounded his views to a British audience four years ago, and his work has proved an important link between psychologists of the U.S.S.R. and the West.

Dr. Tizard, an authority on mental defect, briefly describes the simple experimental technique used, which implies the establishment of a conditioned reflex, even in very young subjects, aged four to five. With this technique, one can study the speed of formation of stable response patterns, over time, and the subject's capacity to change from one set of responses to another, as well as the role of speech in regulating voluntary behaviour.

Dr. Luria's research is a model of its kind, and, although seemingly academic, it will cast a light to illumine future paths of research into this essential human issue, the place of language in mental growth—emotional, intellectual, and, above all, social. All disciplines dealing with human communication depend, of course, upon the adequacy of speech and language.

E. M.

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CORRESPONDENCE

A Family Social Service

The Editors,

Dear Sirs,

As a result of the extensive research into behaviour problems which has been going on over the years both here and in America, a great deal more is now understood than was known in the past about what determines the development of criminal tendencies in children. So much is this the case that an intimate knowledge of the past history of a child enables the experienced worker to predict the outlook for success of remedial treatment and to know that it is not the treatment but the past influences that will contribute to its success or failure. Out of all the factors that influence behaviour, family relationships are seen to be paramount. Parental love and tenderness and consistent handling are as necessary to the normal development of a child as are the essential foodstuffs. If he is deprived of the former his character will be warped just as surely as his body will suffer if he is not properly fed.

Most healthy boys and girls are sometimes mischievous and destructive and some will always break the law. It is not the 70 per cent. that can be successfully dealt with by probation, or any other method, that are the problem. It is the badly maladjusted children who become enemies of society and eventually form the hard core of our habitual and vicious criminals. It would appear that many of these could have developed into normal law-abiding human beings if they had been handled rightly in early childhood. We cannot teach love where there is no love, but in all but a small proportion of cases there is someone with some affection who could learn to show it in a manner which the child would understand and to which he could respond instead of continuing, in his unhappiness, to antagonise all around him.

I would therefore suggest that a *family social service* should be established in an attempt to improve the social health of the community in some such ways as the following:

1. To educate the mother—or mother substitute—in basic principles now known about the emotional needs and development of children (the necessity to *show* love, the importance of a sense of security, the need for consistent discipline as distinct from punishment, the manifestations of jealousy, the significance of nuisance behaviour etc., etc.).

2. To keep in regular contact with families in which either parent is subnormal, alcoholic, or apparently inadequate or uninterested and direct them to sources of help and to hold a watching brief for the children.
3. To supervise families (a) in which there are children cared for by people other than their own parents; (b) where the mother is in wholetime work; or (c) the father is absent for much of the time (sailors, long-distance lorry drivers, armed forces, prisoners).
4. To watch the welfare of children (a) where there is only one parent (death, desertion, illegitimacy, etc.); (b) where there is obvious marital discord; (c) where one parent has remarried, *i.e.*, there is a step-parent.
5. To co-operate with other social services (Children's Department, Education, Mental Welfare, Health, N.S.P.C.C., etc.) and seek their help where appropriate.
6. To help the Probation Officer to understand the family situation if he has to make a pre-trial report—possibly to appear as a witness in order to help the court decide on the most appropriate line of treatment (this would have to be very carefully weighed up).

The health visitor is already the familiar and accepted friend of the family and undertakes much more than merely health education in the course of her duties. She is also accustomed to work in co-operation with other social services. With more training in simple child psychology and management and a lighter caseload, the two functions of Family Social Worker and Health Visitor might be combined. It would be hoped that the experienced family social worker might be able to detect the early signs of unhappiness in children due to neglect, rejection or wrong handling and that help could be given before these led to serious maladjustment with its sequelae of delinquency and neurosis. If the results of such a service were successful, the numbers of violent and vicious criminals would be materially reduced and a proportion of cruelty to children would be forestalled. This would surely be preferable to waiting until the law had been broken before bringing the weight of the remedial social services to bear in an effort to alter anti-social attitudes and habits that have already taken root. If successful it would also save a great deal more money than it cost.

Yours sincerely,

MARY MACAULAY, M.B., CH.B.,

Chairman, Juvenile Bench,
Liverpool County Sessions.

The Editors,

Sirs,

Your reviewer of "Work for Prisoners" does not convey the correct intention of the Advisory Council when it recommended metal recovery work as a suitable substitute for mail bag sewing when this had to be done by hand. As a member of the Liverpool Advisory Council I feel that Pauline Morris creates a misleading impression that should not go unchallenged.

I should like to correct that impression and state that in its report the Council referred to work performed by prisoners at Liverpool and other prisons. This consists of cutting cable and extracting copper and lead for re-use by industry, active work performed on modern machines under similar conditions as in outside industry. This cannot be called "demoralizing" since it is in fact highly productive, as a third of all copper and nearly half of all lead used comes from scrap. The prisoners are thus performing very useful work which, in addition to being of benefit to the national economy, is training for the prisoners themselves in the use of tools.

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Mrs. Morris states that this is dull kind of work, but, in fact, a very large part of modern industry consists of the performance of dull and humdrum tasks. It would be more to the point if she could suggest alternative work, having regard to the trade unions' distrust of prisoners doing work inside prison.

Yours truly,

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The Short-term
Prisoner

A STUDY IN FORENSIC PSYCHOLOGY

R. G. ANDRY
M.A., Ph.D.

Foreword by Hermann Mannheim

Prisons and prison sentences have themselves been 'in the dock' for many years and, particularly in the case of short-term sentences, both practical and humanitarian considerations make urgent the exploration of possible alternative forms of treatment.
The purpose of the inquiry upon which this book is based was to discover, by means of an exploratory psychological study of a group of short-term prisoners, whether there is a solid case for modifying the present system. As a result of this inquiry the author envisages a classification of offenders on the basis of psychological investigation and diagnosis, leading either to medium terms of imprisonment combined with psychotherapy or to a special form of probation involving attendance at a Reconstruction Centre. These proposals are of deep concern to those engaged in psychological and sociological research in the field of criminology.

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EDITORIAL

Mr. Mays' contribution to this issue, "Delinquency Areas—A Re-assessment," highlights one of the basic problems of contemporary criminology, namely the integration of theoretical concepts derived from divergent disciplines which converge on the common problem of explaining delinquent behaviour. There is no doubt that he is correct in his assertion that there has been a turning away from the older concept of the "criminal area" and a tendency to devalue the work of the ecologists of the Chicago school. Unlike the constitutional theories which developed from the work of Lombroso, and which have contributed little if anything to the practical problems of crime control, the work of Clifford Shaw and his co-workers, crude though it may appear in the light of modern statistical techniques, laid no small part of the foundations of contemporary theories of delinquent subcultures so ably developed by Cohen, Cloward and Ohlin.

The common factor in subcultural theorisation is that offenders live in local communities (usually slum communities) in which solutions to the problems posed by the stresses and demands of the wider society are transmitted and reinforced by collective mechanisms of learning and social control. Posed against this body of theory—which is by no means as unsophisticated as some of its critics would believe—is a contrary body of theory which identifies the origins of crime within the family situation. According to Mays, the Gluecks refuse to treat gang membership as a causal factor, arguing that offenders were "maladjusted and delinquent children long before they were gang members." A similar viewpoint is attributed to Dr. Stott. The difficulty with this view is that it strongly equates delinquency with maladjustment; unfortunately, the concept of "maladjustment" is by no means easy to define outside a comparatively narrow operational context. It does not follow that the criteria of maladjustment deriving from the situation of the psychiatric clinic are applicable to the street. Not all delinquents are solitaries, liars, and bedwetters, angry and resentful against authority. Nor are they all unloved. Mr. Mays, not unreasonably it would seem, suggests that a complete "sell-out" to the psychoanalysts, casting aside all we have learned about culture transmission processes in urban neighbourhoods, brings us back towards a theological notion of original sin which is a metaphysical rather than a scientific concept.

His own preference is to look more closely at the group termed "offenders," and to distinguish between those whose behaviour is clearly problem-solving in terms of personal psychopathology, and for whom the delinquent solution merely happens to be the most readily available, and those offenders whose behaviour is a normative response to the collective pressures of peer group culture. While Mr. Mays does not underestimate the importance of the home as a factor in the aetiology of crime and its role in personality formation, his view is that one way in which to advance criminological theory is to explore the relationship between criminally disposed personality and the social structure. At the moment, he argues, mainly individual studies are blocking from vision the implications of the wider changes in social structure which are occurring in urban societies throughout the world.

As Dr. Shoham writes, theories of criminality are possible if certain conditions are observed. His remarks are directed against those extreme pragmatists who, taking the easy way out, argue that any kind of theory-making in criminology is futile or downright impossible. They are also directed against those who, like Merton, believe that the legal concepts of crime and delinquency are fundamentally unsuitable to serve as a basis for theoretical analysis in criminology. Shoham realises that if we do not slavishly stick to the legal concepts but employ them wisely within the obvious limits of their usefulness, we may well, and may indeed have to, construct theories to assist us in our understanding of criminal behaviour.

To dispense with theory-making altogether would mean the bankruptcy of criminology as a scientific discipline. Such considerations do not of course justify the present over-abundance of theoretical speculations which all too often claim originality whereas they are in fact nothing but insignificant modifications of old-established, though perhaps questionable, theories.

After clearing the way for criminological theory as such, Shoham proceeds to a discussion of the respective merits of the theory of differential association and its critics, stressing in particular the need for " theories for restricted and behaviourally distinct segments of crime in a given community," instead of theories trying to deal with crime in general. What he calls the " unitarian fallacy " shows itself not only in attempts to look for " common causes of tax frauds and indecent exposure "; it also shows itself in attempts to apply to first offenders the results of studies of recidivists; it further shows itself in the failure to distinguish between theories dealing with the " recruiting " process and recidivism, on the one hand, and theories trying to explain crime on the social level, on the other. Here, on the social level, no single theory can explain such diverse problems as " the upsurge of criminality during the prohibition era in the U.S. and the criminal tribes of India." And, finally, theories relying exclusively on defects in the normative system, such as anomie or culture conflict, are usually too abstract to be easily related to actual phenomena. In this latter respect it is certainly true that, as most of these theories have originated—or, at least, been developed and popularised—on American soil, their applicability to other countries has to be carefully checked, and in Israel, to which the author refers at the end of his article, social and psychological factors and problems might possibly be so widely different from those in the U.S.A. as to make a wholesale acceptance of those theories a risky undertaking.

The occurrence of epilepsy has from time immemorial attracted the attention of physicians and laymen, probably before Hippocrates described the *morbis sacra*. This very term suggests a mysterious quality which invaded the whole personality of the victim. Lorentz de Haas brings up once again the relationship of the convulsive disorder to behaviour in general and to criminal behaviour in particular, and points out that the condition is associated, not only with the admittedly outstanding feature, the convulsive seizure, but with the prelude of irritability and the postlude of ominous automatism in some cases. The violence of a seizure and the occasional irascible pre-ictal conduct arouse in the mind of the unwary the all too easy conclusion that this is *par excellence* the *fons et origo* of aggression and the criminal consequences that are associated with it—murder, rape and the sexual aberrations.

Dr. de Haas certainly expresses in his article the opinion of most close observers of this condition, namely that violence is not an inevitable accompaniment and the so-called epileptic character is rarely centred around aggressivity, although egocentricity has been claimed by some observers, for example the late Pearce-Clarke who drew an all too vivid image of the epileptic personality.

A good anamnesis, however, reveals in many cases that those who have performed violent deeds in the so-called post-epileptic state are unusual persons in a wide sense, sometimes absurdly pacific, at other times psychopathic, unreliable and stagy. Literature has to bear some of the blame for the facile equating of epilepsy with bizarre and even dangerous and exalted features in character—St. Paul and Julius Caesar, Flaubert and Dostoievsky and others of less eminence.

Epileptic predisposition and the accompanying character ought to be studied separately in order to advance scientific correlations which would bind together the two which in clinical experience are so frequently not related at all. The discovery of the E.E.G. has opened up a new avenue of research and a new dimension in the construction of reliable psychophysical patterns. But E.E.G.'s are not, as the non-expert suppose, indicative solely of the presence or absence of epileptic discharge centres. They disclose the area of tumours, immaturity in cortical development in some children with episodic behaviour disorders, cortical abnormality in some aggressive psychopaths, and all these with neither clinical nor E.E.G. evidence of epilepsy. These wider studies, therefore, must occasion additional difficulties in making medico-legal decisions in cases of criminal conduct which arouses medical suspicion.

As de Haas states, the frequency of crime of all kinds in the population at large is relatively much greater than it is found to be in the population of manifest epileptics, and be it added in those with the additional evidence of the spike and wave appearances in the E.E.G. Epilepsy is a plurality of conditions and not a clear-cut one of convulsive phenomena with or without those disturbances of consciousness which only careful history taking can reveal.

Despite the passage of nearly a hundred years we can still learn much from the master neurologist, Hughlings Jackson, who, much influenced by the evolutionary views of Spencer applied to neuropsychology, said in 1873: " . . . Hence we do not say that any kinds of mental state *arise from* nervous discharges but that they occur during nervous discharges." He stresses that we must, despite the facts of the nervous substrate of conduct, deal separately with the psychical state. In short, the mental history, even in a known epileptic subject, must be carefully unfolded before a final decision as to the causes of conduct, criminal or otherwise, can be defined and utilised in medico-legal decisions.

Dr. Little's interesting article on the subject of current ideas for penal reform should stimulate and provoke many readers. His argument is that nearly all the reforms currently demanded have in fact been realised in the borstal system and that the results are not encouraging. "A reformed system does not appear to be doing any better in changing offenders into non-offenders than an unreformed system."

If this is true, and if it is correct to conclude with Dr. Little that " there is no available evidence to suggest that the programmes of reform advocated by government bodies and by penologists will have any impact whatsoever on the overall reconviction rates of offenders," then the outlook is indeed bleak. As Dr. Little observes, these reforms might have to be justified on purely humanitarian grounds, or simply as a necessary pre-condition for other reforms, as yet unspecified, which will be truly effective.

But there is clearly room for argument over at least two of the author's premises. It may be said, first, that the borstal system is by no means fully " reformed," and in any case it has been subjected to unusual and unprecedented pressures in recent years, both in terms of numbers and the quality of the intake (which has seriously declined: see Prison Commission Report, 1961, Cmnd. 1798, p. 45).

Secondly, the criterion of success adopted by Dr. Little may seem a little crude. " Success for this purpose is taken to be not reappearing in court." The Reports of the Prison Commission no longer enable us to distinguish between those who were only reconvicted once and those who have been more often reconvicted, and yet it is widely recognised that one lapse does not necessarily mean total failure.

Furthermore, as Mr. Klare points out in his comment, the reforms which he has proposed have certainly not been tried. It may well be that while Gresham Sykes' list of characteristics of a reformed system still contains much that is desirable on several grounds (not only the improvement of the success rate) it is more useful as a list of goals for the American penal systems rather than as a guide to the future of the British system. Nevertheless Dr. Little is surely right in drawing attention to the way in which we have assumed the desirability of generalising from the borstal practice and extending this to other groups of offenders when there is no guarantee that it will produce any better results. These are indeed sobering thoughts.

We are glad to welcome back Dr. Maxwell Jones' contributions to the journal and look forward to his further pioneering work in Scotland. Throughout the post-war years he has courageously demonstrated the practicability of his social rehabilitation unit, the principles of which he summarises in this issue. The basis of the method is clear: a friendly, permissive community of patients and therapists in which the patient, through insight, transference and group pressures, relearns the business of life. Grafted on to this are certain adjuvants: elevating status, inducing participation, feeding back communications, outsmarting the deceiver (a method also described by Aichhorn, Homer Lane and Eissler); he might also have mentioned the impact of his own personality and of his social therapists (elsewhere described as young, attractive, untrained and of responsive temperament [1]). No doubt there are other techniques which he tried and rejected, for example, psychodrama, about which it would be interesting to hear.

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[1] Rapoport, R. N. *Community as Doctor.* London 1959.

We would like to know more. Is the régime reproducible by others, or does it change with a different director? Possibly a comparison of the Belmont unit with the Henderson Hospital would be worth attempting. What sort of patients stay the course and what sort are either declined admission or leave before treatment has started? Especially we would like to know the results of treatment. There is Rapoport's follow up for one year of seventy patients suggesting that those with least "psychic disability" and most "personal resources" do best; that intensive community therapy is no better than no therapy unless of more than six months duration; that the majority show improvement on discharge but relapse frequently in the first few months; that those who identify most wholeheartedly with the community do less well outside. But this excellent study did not fulfil the modern requirement that, in order to assess treatment, not only the treatment method but also the personalities of the patients *and* of the therapists must be studied. Also, as Dr. Jones must have learnt in his Californian travels, there is a real danger of doing more harm than good if a sound method of treatment is applied to an unsuitable patient.[2] It is easy to call for, but one nevertheless hopes that the pioneering phase will be followed by a stock-taking phase.

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[2] Adams, S. *Interaction between Individual Interview Therapy and Treatment Amenability.* Monograph 2. Board of Corrections. State of California. July 1961.

DELINQUENCY AREAS—A RE-ASSESSMENT

JOHN BARRON MAYS (*Liverpool*) *

RECENTLY there has been a growing reaction amongst criminologists against the idea of the criminal area or, as it has also been sometimes called, " the delinquency-producing neighbourhood." [1] In so far as this turning away from the concept of community-centred delinquency has led to a profounder understanding of some of the causal factors involved in what may be termed " family-based " criminality the swing has proved generally beneficial. But if it is to be interpreted, as I think it sometimes can be, as a denial of the importance of the contribution that sociologists can make to our understanding of the aetiology of criminal behaviour, then I think our theoretical losses greatly outnumber our gains. Some writers on crime seem to deny that social factors can ever be primary in the same way that psychological factors could be so regarded. While all are not prepared to go so far as to deny any significance whatsoever to the social background, they tend to think that the kind of culture in which offenders happen to live is never more than contributory. They are not prepared—or so it seems—to admit that influences operating within the general social structure as well as forces at work in the local milieu are really crucial in the aetiology of criminal and delinquent behaviour.

One of the consequences of this reaction against a predominantly social interpretation of crime has been the tendency to belittle the contribution of the ecological school and, in particular, the work of Clifford Shaw (1942), and his collaborators in Chicago. I am of the opinion that the latter's researches, especially those incorporated in that massively impressive volume, *Juvenile Delinquency and Urban Areas*, constitute one of the few major advances recently made in criminological science, equalled only perhaps by Burt's

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[1] Morris (1957) is a notable exception to this generalisation. His researches suggest that the concept of the delinquent subculture could usefully replace the older and less exact concept of the criminal area as defined by the Chicago ecologists.

The Young Delinquent in its detailed exposition of a thesis which has proved to be widely applicable and productive of new insights. It seemed worth while therefore to take another look at the criminal area theory with which Shaw has above all been associated and to attempt a reappraisal of its validity in the light of recent criticism and discussion.

The multi-causational approach to crime is now widely accepted and quite obviously it fits the known facts more adequately than any theory of single causation such as " moral depravity," poverty or mental disease. This view, to which Sheldon and Eleanor Glueck have made monumental contributions, and which was, incidentally, implicit in Burt's study, has on the whole proved unfavourable to explanations based largely upon ecological or sociological analyses. It is not merely a matter of placing the latter within a wider perspective: but goes rather further in the direction of a critical rebuff. The Gluecks (1952) have on many occasions voiced their scepticism about a purely or mainly sociological approach to crime. Their views are worth quoting at some length because they are a spearhead in the main attack.

> " For example, a weakness or an incompleteness of much sociologic reasoning on the causal processes of crime is the assumption that the mass social stimulus to behaviour, as reflected in the particular culture of the region, is alone, or primarily, the significant causal force. This presupposition ignores two undeniable facts; first that in every society—whether largely rural or largely urban, whether agricultural or industrial, whether composed essentially of one ethnic group or of many, or of a consistent culture or several clashing ones, whether existing at one historic period or another—there have been individuals who would not or could not conform to the taboos and laws prohibiting particular forms of behaviour; secondly, and relatedly, that differences exist in the responses of various individuals or classes of person to many of the elements in the culture-complex of a region.[2]

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[2] If it were not that it would interrupt the argument, one would dearly like to know what the authors mean by " classes of person " in this context. If they are talking about social classes in the ordinary sense of the term are they not themselves being guilty of the kind of sociological offence they are condemning?

> "The true significance of the factors dealt with by the area sociologist can be determined only through close study of the points of impact of social forces upon *individuals* of varying *biologic make-up and childhood conditioning*. The varieties of physical, mental and social make-up of different persons must determine, in large measure, the way in which they will be influenced by social disorganisation, culture conflict, and the growing pains of the city. To over-emphasize the neighbourhood matrix as a coherent whole and under-emphasize or virtually ignore the biologic make-up and childhood developmental history of the different human beings who themselves contribute to the modification of that matrix is to overlook many of the factors that account for variations in the effect of the culture on human beings and thereby distort reality with reference not only to the causal problem but even to the nature of the culture in question."

The main purpose of the paragraphs just quoted is to assert the uniqueness of the individual in his reaction to common social stimuli and to account for a differential response in terms of personal history and constitution. So far so good. While it may well account for the odd person who breaks the taboos and defies the group laws, it fails to account for the many who conform. From the Gluecks' viewpoint the criminal is the one who breaks the taboos; from the area sociologist's point of view the criminal is the one who conforms to the deviant mores of the local sub-group. The fact that in a geographically delimited area many people do not behave identically does not vitiate the theory that certain forms of behaviour arise from a common acceptance of norms operating in a small sub-cultural group and that these may in special instances involve acceptance of legally prohibited behaviour. It merely means that we have not succeeded in mapping out adequately the network of social contacts of a sufficient number of socially connected individuals. The areas which the ecologist defines as criminogenic are in many instances inexact. The lines have been drawn in too roughly; the picture is not so much a portrait as a sketch in process of becoming a more exact representation of the facts. What the Gluecks call the culture-complex of a region may indeed not exist statically in space and time, or it may be only imperfectly defined. We use a term like "neighbourhood" very loosely indeed, and when we talk of a criminal area or of a delinquent subculture we are not saying that every individual living spatially close to the offenders is so powerfully conditioned by their attitude and behaviour that he is obliged to break the law himself. What we are saying is that within a broad zone which can be drawn on a map a very substantial number of people commit offences and there is a general social tolerance extended towards this behaviour. The majority of the residents in that zone may not be offenders (we don't in fact know whether this is so or not)[3] but there are sufficient people who are criminal, and a further unspecified number who are, at any rate, neutral towards this behaviour, living there for us to be able to say that the area as a whole is "delinquency producing" as far as its general social climate is concerned. The exceptions do not disprove the generalisation.

Part of our difficulty resides in the theoretical model of social contacts we construct. We tend to think of a community as being a number of people who live side by side and have social intercourse and hence develop a common way of life. But, in cities, this clearly does not happen very frequently. Localities are more mixed than we often suppose. At the same time, the findings of Shaw and McKay (1942) for Chicago, and many other major American cities, point to the fact that over a number of years and even in areas where the actual composition of the population changes fairly rapidly, the crime and delinquency rates remain more or less constant. Burt (1925) secured addresses for the boys and girls reported as Industrial School cases in the London area in the year 1922–1923, and then calculated the ratio between the number of cases in each electoral area and the total children on roll at council schools. Ratios varied from 0·42 to 0·0, while the average for the whole city was 0·14. He showed on his maps that the highest rates (0·25 and upwards) were located adjacent to the central commercial district, while the lower rates (0·05 and less) were in suburban neighbourhoods. His high delinquency areas corresponded to the old

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[3] Trenaman (1952), however, in his valuable appendix to *Out of Step*, has cogently argued that we invariably tend to underestimate the proportion of convicted and delinquent members in the community at any one time.

Low neighbourhood described by Mayhew and also to the poverty areas identified by Charles Booth. Thus, they tended to confirm the ecological and zonal theories about the distribution of crime that Shaw and his colleagues developed over succeeding years. Moreover, any Chief Constable could verify the fact that very many more arrests are made in older inner urban districts than are made in the suburbs; that the slums, in fact, are the problem areas as far as the police are concerned. The only exceptions to this generalisation are those new housing estates which have been developed to accommodate residents of the former blighted neighbourhoods and here, very clearly, we are dealing with the same people transferred to a different geographical setting, a fact which gives substantial support to the criminal area theory.

The " problem of all problems " in criminology is how to account for this almost universal phenomenon. Obviously the bricks and mortar cannot account for the steady crime rates in these older and deteriorated urban districts. It has been suggested that these differential crime or rather arrest rates between lower class and middle and upper class districts are no more than a reflection of police attitudes and activities, that police tend to prosecute members of poorer and lower status communities for offences which they would deal with differently elsewhere. While there may be some discriminatory practice in police methods between neighbourhoods, it is hard to believe that this can account for more than a small proportion of the difference in prosecutions between varying status areas. Police, after all, like all specialists and professionals, have an institutional and vocational urge to demonstrate their efficiency and skill by securing successful prosecutions. What I think is much more likely to be the case—but it is obviously extremely difficult to prove by objective evidence—is that, in better-off localities, a substantial number of offences are never reported to the police at all. That in itself, if true, is an important sociological clue to our understanding of crime and delinquency. But, however much illegal conduct is hushed up in suburbia, we still have to account for the high volume of crime known to take place and be committed by residents in the older, blighted neighbourhoods near the city centres. Even the presence of temptation in the shape of warehouses, shops, offices, railroad yards, docks and markets cannot be more than partially responsible. One is driven back to the earlier explanation that a delinquent and crime-tolerant social atmosphere prevails in such localities; that there is, as it were, not so much a community of individual people as an abiding community of ideas, values and attitudes which is developed as a social tradition and handed on, more or less intact, to the rising or incoming generation. Language, we know, and street games and certain rituals of play are handed down in this sort of way, so why not other forms of behaving such as shop-lifting and certain types of larceny?

It has sometimes been objected against Shaw's delinquency areas theory that it is deterministic and that it " postulates a direct causal connection between deterioration of physical environment and delinquent behaviour " (Wilson, 1958). Neither of these objections can be successfully sustained. Shaw did not maintain, even in his blackest of black areas, that delinquency was anything like 100 per cent. Hence he accepted differing degrees of response from different individuals, and did not suggest that anyone who lived in such a locality for any length of time must inevitably become a criminal.

Harriet Wilson's criticism stands even more precariously poised on the brink of illogicality. Merely on the basis of the findings of the researchers involved in the Radby study (Jephcott and Carter, 1954), which revealed that residents of similar streets in working-class neighbourhoods nevertheless lived by different ethical codes, she naively concluded that " these findings will finally dispose of the ecological argument." In the first place, Radby is no more than a small town. Hence its delinquency area is accordingly reduced to a few streets like Dyke Street. Shaw and others were writing about large cities which during the process of their growth have thrown up what are often called—I think mistakenly—" natural areas," where a definite pattern of social life has been allowed to develop, in much the same way as the easy-going, delinquency-tolerant pattern of life in Dyke Street has grown up and precisely as the more austere, law-abiding, status-conscious culture of Coronation Road has emerged over the years. Moreover, it must be remembered that even in Dyke Street actually criminal households are in the minority (no more than 40 per cent. have come into conflict with the law over a fair period of time).

Shaw particularly emphasised the fact that " Delinquency—particularly group delinquency, which constitutes a preponderance of all officially recorded offences committed by boys and young men —has its roots in the dynamic life of the community " (Shaw and McKay, 1942).

The dockland areas of South Liverpool which I myself knew intimately and which I was led to categorise as a " delinquent community " as a result of my experiences living there, is much more akin to Dyke Street than to Gladstone Road (Mays, 1952 and 1954). It is built up of a number of Dyke Streets, some tougher and rougher and more delinquent than others, but not all the residents of even its blacker streets are either delinquent or tolerant in their attitude towards offending neighbours. Varying shades of grey probably predominate. Nevertheless because social interaction takes place and, in the case of the children, is almost impossible to prevent, the dangers of what we may metaphorically refer to as " social infection " are ever present. To deny this seems to me to deny the evidence of our own eyes and ears. But several writers appear to be unprepared to give much weight to group influences as determinants of behaviour. The Gluecks (1952), for example, refuse to treat gang allegiance as in any way causal as far as the subjects of one of their major inquiries are concerned. They assert that " by and large, they were maladjusted and delinquent children long before they were gang members. Gang membership may have multiplied their antisocial activities; it rarely originates persistent delinquency." Dennis Stott (1959) in his study of boys on probation in Glasgow also goes to some trouble to undermine the " delinquent neighbourhood " explanation. He found that concentrations of convicted boys were " rather within ' small pockets ' of one or two streets than whole neighbourhoods in the traditional sense." But Brennan (1959), describing his researches in the same city, picked out the Nethan Street area from the rest of Govan as constituting a specific " delinquent society " in my meaning of the words, housing as it does 90 per cent. of all probationers in the ward yet constituting only 10 per cent. of the ward population. While we must accept the fact that delinquency areas or delinquent communities, call them by whatever term we like, are comparatively small in British cities and towns, and that for this reason the concept of the large criminal zone as originally described by the Chicago school is not viable in this country, this by no means does away with the idea that social factors may exert a primary influence in many cases of crime and, more particularly, in the delinquency of children and youths. If the large scale delinquency area is a predominantly North American phenomenon, miniature sources of delinquent behaviour and influence nevertheless are to be found in Britain and, in the larger cities, they apparently comprise fairly substantial numbers of people, *e.g.*, in the Govan ward of Glasgow no less than 10 per cent. of the populace.

The Gluecks and Stott, however, would have us go even further in demolishing any mainly sociological explanation of criminal attitudes and activities. They seem to believe that the source of all illegal conduct is to be found in the offenders' home lives and family relationships, in what the Gluecks aptly term the " under-the-roof-culture." Their approach is, therefore, more psychological than sociological. According to Sheldon Glueck (1956), children do not need to be taught delinquent acts. They come naturally enough to the majority. Lying and stealing, fighting and sex play arise inevitably from the operation of instinctual urges and drives. He concludes, therefore, that " it is rather *non*-delinquent behaviour that is learned. Unsocialized, untamed, and uninstructed, the child resorts to lying, slyness, subterfuge, anger, hatred, theft, aggression, attack and other forms of asocial behaviour in its early attempts at self-expression and ego formation." He is clearly, in this passage, " selling out " to the psychological and psychoanalytical theorists, and it seems to follow inevitably from this point of view that education is no more than a form of adjustment to prevailing normative standards. In theological terms we are back to the doctrine of original sin, fallen and sin-afflicted human nature, and the necessity for discipline, habit training and psycho-therapeutic techniques for our ultimate social salvation. Stott (1959) is largely in agreement with the idea that delinquency is a form of psychological maladjustment. " My own explanation," he says, " is that the delinquency-rate is really in the main a reflection of a hidden maladjustment-rate . . ." And this holds true of the so-called " black " areas as elsewhere. The latter are not only, according to this view, more delinquent, they also contain more maladjusted people than other localities.

Summarising very briefly the argument so far, it would appear that the concept of the wide delinquency area of several thousand people is giving way to the notion of small pockets of antisocial families, and that the further examination of these streets or pockets where illegal behaviour is most common is resolving itself into an examination of the attitudes, and personal relationships within particular families, and of the moral training, or lack of it, in individual households. A study of the wider social group then has given way to research into relationships within a much smaller social group, which is, in turn, explicable in psychological rather than in sociological terms. The logic of this analysis leads us to the conclusion that individual treatment of the offender is the only way to control and reduce the problem of crime in society, and that techniques for assisting families to function more effectively in ways, for example, discussed by John Mack (1953) in his report to the Carnegie United Kingdom Trust will provide the requisite preventive service. I have myself gone some way to examine this thesis in terms of a special club designed to assist families with delinquent children to cope more effectively with their problems in a part of Liverpool where crime rates are high and juvenile delinquency is generally accepted as a grave and widespread social problem (Mays, 1959). It is, therefore, a view with which I am in sympathy, and yet one which I am convinced only carries us part of the way towards an understanding, let alone a solution, of the general problem.

This brings me back once again to the contribution of sociology to the study of that species of human behaviour which is designated crime. This contribution is, I think, twofold. First, an analysis of the structure of the wider society enables us to see what place criminal behaviour occupies within the entire social context. We can appreciate the major social forces, economic, political and cultural, which make it almost inevitable that, in a society which is largely concerned with the acquisition and retention of property, goods and money, some people and certain disadvantaged classes will feel themselves debarred from enjoying their share of the rewards of industrial productivity. As a result, feelings of frustration and subsequent resentment arise which may, in certain instances, result in aggression against the wider society and infringements of the legal code. The analyses of Merton (1949) and of Albert Cohen (1956) are sufficiently well-known and respected for us not to need to labour this point beyond perhaps suggesting that in their use of the adjective "sociologic" the Gluecks have consistently underestimated this aspect of what might be termed "global" sociology in their analysis of sociological factors. Secondly, the concept of culture, as applied to the organised and traditional social life of a small group of people, enables us to see how unity may exist in apparent diversity and underlines those aspects of human nature and behaviour which are truly common and subsequently communal. I take it as a social fact that a small group of people who interact frequently and intimately over a fair period of time establish as a result a more or less formal pattern of relationships and what are often referred to as "rituals" for transacting their business and standards for regulating behaviour in the group situation. Something of this nature, it seems to me, obviously occurs in those "black pockets" in delinquent neighbourhoods which we have been discussing, and in so far as this happens it constitutes a phenomenon as much within the sphere of the sociologist as of the psychologist. Stott, in my view, tends to underestimate the significance of local culture in the aetiology of delinquent behaviour. It is true that the family is the institution concerned most closely with the upbringing of children. Hence it is in the family situation that the local culture is mediated to the growing child. The fact that the parents are the vehicles for this transmission does not, however, affect the claim that a substantial part of any code of conduct that they transmit is of a social origin and has previously received the *imprimatur* of social approval. It is not enough, therefore, for us to understand all we can about the psychological relationships in the family circle if we wish to unravel the threads of delinquency causation. We must also know something about the local culture in which the family is located; that is to say, something of the way in which a particular local group think it is right and proper to bring up children and for husbands and wives to associate. To say, as Stott seems to imply, that the community of delinquency-tolerant families in Dyke Street is necessarily maladjusted is, in my view, to argue in a circle.

Freud (1959), in fact, has taken an altogether wider approach than many of his followers. In one of his final essays he says:

> " The parents' influence naturally includes not merely the personalities of the parents themselves but also the racial, national and family traditions handed on through them as well as the demands of the immediate social milieu which they represent."

There is, of course, one way in which the apparent disagreement between the sociologically and the psychologically oriented criminologist may happily be resolved. That is by making a theoretical distinction between " true " and " pseudo " delinquents; that is to say, between those offenders who, either as a result of inherited constitution or as a consequence of personality malfunctioning arising during the course of an individual's life history, are impelled by inner necessity to break the law, and those, on the other hand, who are merely temporary victims of group suggestion. Delinquency is not only the outcome of many differing causes; it is further manifested in a whole variety of different forms of behaviour which, only for the purpose of legal administration, are generally subsumed under the same title. As a psychiatrist colleague of mine put it, the real delinquents are genuinely maladjusted, their delinquency is of the nature of a distress signal, and if one form of communication ceases to attract attention, then they will select some other kind of deviant behaviour with which to register their problems. Once again I must confess the immense attraction that this view holds for me. I would gladly concur in it if the adjectives " true " and " pseudo " were to be eliminated. It seems to me that both kinds of delinquency are genuine but they are of different types. The first type is deep-seated and often intransigent to treatment; the second type is more benign in nature and more amenable to retraining and educational techniques. In one case, the causal complex is rooted in the psychology of the individual offender; in the second case, the delinquency is largely a function of the local environment. This simple diagnostic distinction is to my mind crucial for any understanding of crime *en masse*. It is simple yet fundamental and is the starting point for any worthwhile classification, and classification, in turn, is the beginning of sophistication in both criminology and penology. The difference between the mainly socially and the mainly psychologically motivated delinquent might also be described in terms of the other-directed and the inner-directed personality. One offends, in the main, because his pals do; the other because he is psychologically disturbed. One is driven by the desire to conform; the other is compelled by inner necessity. One is normal, the other is abnormal. One passes through a phase of illegal behaviour during childhood and early adolescence, while the other is more likely to develop into the habitual offender. The old lag, as we know, usually commits his offences alone, while environmental delinquents are invariably accompanied.

We may now return to the examples of recent research already discussed in which there appeared to be an irreconcilable dichotomy between the sociological and psychological viewpoints, to see how far these apparent differences may be reconciled. The Gluecks (1950) were examining boys whose criminal behaviour was already well advanced and who had for that reason been committed to a reform school. They comprised, therefore, a selective not a random group of law-breakers. Again, Stott's Glasgow boys had been put on probation and were also something of a specialised group. Even allowing for the peculiar mental processes of some magistrates, it is likely that some general selective principle operates in deciding which boys would and which would not be likely to respond to probation treatment. Stott himself, in fact, shows to my way of thinking, that this is indeed so. One of the prognostic factors to which he gives a central position is a hostile attitude towards other children. Now a hostile attitude towards other children, I would submit, is itself abnormal and atypical of most of the juveniles who are brought before the courts and whose escapades serve to fill out the Home Secretary's annual statistics so liberally. It characterises that sort of person who is likely to find himself in later life an inmate of a Preventive Detention prison. As R. S. Taylor (1960) showed in his study of detainees at Wandsworth, habitual criminals, who are, by definition, abnormal, are typically solitary offenders. Social avoidance, in fact, is one of their dominant characteristics. Taylor's findings coincide very neatly with Stott's since both their groups, the one obviously more so than the other, belong to that sector of the delinquency spectrum which is dominated by individual psychic states and by inner-directedness generally. They do not relate easily to other people, even to other offenders, while many of the youngsters who were typical of my own Liverpool dockland community were highly gregarious. These latter boys, when they are delinquent, offend almost incidentally.[4] Their delinquency is often a means to achieve social acceptance by a group of peers or near-contemporaries. To a very considerable extent, they seem to derive their springs of action from the group, and the fact that, at times, the groups to which they relate are engaged in some activities proscribed by the laws of the wider community is a result, I would hypothesise, of the socio-economic status of the neighbourhood. This in turn is explicable only in terms of a long history of social disadvantage, comparative poverty and group inferiority feelings *vis-à-vis* the more prosperous members of the wider society by whom earlier residents in these underprivileged areas felt themselves in some ways victimised, spurned and exploited. The delinquency of the dockland boys I studied in Liverpool is a function of the social structure of the locality, while the delinquency of Stott's Glaswegians, on the other hand, is, by and large, a function of the psychological history of specific individuals.

Again, Mrs. Wilson's study of so-called problem families in Cardiff, from which she derived her thesis that "The pattern of living of problem families generates juvenile delinquency," is based, like Stott's, on a selective sample.[5] In her research, she took a group of families who had been referred over a three-year period to the Cardiff Co-ordinating Committee by social work agencies. Although she declares that these families were not referred for any common features other than inadequacy of performance in the British Welfare State, we are, I think, entitled to be sceptical on this point. We all know the ways of social workers! Moreover, one of her final conclusions is something of a give-away: "It was one of the original objects of the survey to compare problem families having delinquent boys with problem families having none. This proved to be impossible. Of the forty families with boys 'at risk,' there were only ten whose children had not been convicted."

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[4] This does not mean that they are not to be classed as delinquents. Their offences are real enough.

[5] My own researches, of course, have also been been based on selective samples, but this does not invalidate their significance as this bias was taken into account in formulating the conclusions.

I have selected for discussion these two research accounts by Stott and Wilson because they both represent a point of view which is increasing in influence. This view holds that delinquency is home rather than community centred, and that the particular place of residence of delinquents is of little aetiological significance, although it must be said that the Gluecks do not go nearly as far as this in their writings. Such sectional research has led inevitably to sectionalist interpretations of the meaning of delinquent behaviour as some form of maladjustment. I am concerned, not to demolish the viewpoint that personal inadequacy can sometimes be a cause of or contributory factor in the causation of some individuals' delinquency, but to place it within a wider sociological context. If it is possible to show, as I think it is, that sociological factors exert a fundamental influence on the types of crime that people in different social classes tend to commit, it seems reasonable to admit that sociological factors are at least as basic as psychological ones. Admittedly " white-collar " criminals are more difficult to track down and study than are lower class delinquents, but enough is known about them to indicate that there is a close connection between social class and criminal activity. " Not only," to quote Marshall B. Clinard (1956), " does white-collar crime differ from ordinary crime in the methods of dealing with crime, but also in the status of the offender, the toleration of the public, and the social support of the offenders."

One way to advance criminological theory, it seems to me, is to explore more fully the relation between criminally disposed personality and the social structure. The psyche interprets the culture, it is true, but the culture equally operates upon the individual pysche. If this were not so, there could be no such study as social psychology at all. What I am advocating here is a development of the various ideas and insights already provided by sociologists such as Durkheim, Merton, Shaw, Sutherland, Reckless, Cressey and Clinard. In this way it may ultimately be possible to incorporate both sociological and psychological theory in a more general body of criminological knowledge. This seems to me a potentially fruitful source of inquiry, but one that may provoke disturbing reflections on the nature of our society and its materialistic goals. This is not likely to happen, however, while we insist, in spite of Freud's injunction already quoted, on narrowing our view to a study of individual inadequacy, defective super-ego development and emotional complexes operating within the family circle. At the moment these mainly individual studies are blocking from vision the wider trends and changes in the general social structure to which the rising urban crime rates throughout the world seem to be pointing.

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THE THEORETICAL BOUNDARIES OF CRIMINOLOGY

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CRIMINOLOGISTS, states Van Bemmelen (1959), are " Kings without countries " because their territories have never been delineated. It might be more adequate, and to be sure more humble, to regard criminology as a permanent guest who must dine, in order to survive, at other people's tables. Criminology draws its basic concepts and methodology from the behavioural sciences, biology and, to some extent, the history and sociology of criminal law. This is mainly due to the fact that crime is differently dealt with by various disciplines. An offence is first of all human behaviour which is in the realm of psychology, psychiatry and biology. It is also a social deviation and belongs therefore to the domain of sociology and social psychology; then it is an infringement of the criminal law dealt with by the policeman, the lawyer and the judge. This reliance on other theoretical disciplines is not a matter of choice, because a criminological frame of reference hardly exists. This may be largely due to the fact that the clashes between human behaviour and the criminal law norms, *i.e.*, crime, cannot be regarded as a *sui generis* behavioural entity. Moreover, many have argued that theory-making in criminology is largely futile (Radzinowicz, 1960) or simply impossible (Michael and Adler, 1933).

The former represents the extreme pragmatist view which pays little attention to the etiology of crime, and contents itself with the trial-and-error approach to criminal policy: this pragmatist, " no-nonsense " approach has much in common with that of the owner of a faulty wireless set who bangs his set in order to stop its rumbling. The chances of the set ceasing its rumbling or ceasing to play altogether are usually equal. Those who claim on the other hand that theories of criminality are impossible base their arguments on indeterministic premises, which exclude generalisations on human behaviour. The so-called eclectic approach to crime causation may also be included in this category because in its " pure " form this approach claims, in the last analysis, that everything may cause crime (Frankenstein, 1955). Even if we disregard these two extreme approaches we still have the argument stated by Merton (1957, p. 177) that theories of crime and delinquency are inadequate because: " . . . The concepts of crime and delinquency may serve to obscure rather than clarify our understanding of the numerous variety of deviant behaviour to which they refer. In the course of assigning a term such as crime or delinquency to a class of behaviour, there develops a tendency to attend primarily to the similarities—consequential or not—between the items of behaviour encompassed in that class. Sociologically quite distinct forms of behaviour by youngsters come to be designated by the generic term ' juvenile delinquency.' This often carries with it the assumption that the wide diversity of behaviour of the individuals engaging in one or another form of this behaviour are of theoretically like kind. . . . Furthermore, the decision to encompass a wide array of behaviour in the one rubric of crime or delinquency tends to lead to the assumption that a single theory will account for the entire range of behaviour placed in this category. This is not too remote, in logical structure, from the assumption of a Benjamin Rush or a John Brown that there must be a theory of disease rather than distinct theories of disease—of tuberculosis and arthritis, of Ménière's syndrome and syphilis." This may be regarded as the most serious argument against an independent criminological frame of reference. Our main task in the present paper will be, therefore, to illustrate that theories of criminality are indeed feasible provided certain conditions are observed. It is necessary, however, to review some of the main controversies which prevail in modern criminological thought. These controversies are a healthy phenomenon in a young discipline provided the issues are real and not superfluous.

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The Controversies

The various theoretical systems prevailing in modern criminology may be arranged between the two extreme poles of a continuum.

At one end are the biological and structural defects of personality theories.[1] These may be called for clarity's sake "personality theories." Some of them use the unitarian technique of attributing criminal behaviour to one cause, whereas others choose a group or cluster of factors which are significantly associated (statistically) with violations of the criminal law. It should be pointed out, however, that the latter rarely differentiate between correlation and association (*i.e.*, statistical prediction) and causation. The Gluecks (1960, pp. 295–296), for instance, assure us categorically that their prognostic devices unravel the causes of juvenile delinquency. A rare exception is the prediction work done by Mannheim and Wilkins (1955) who humbly confess: "We shall make no claim to unravel causes of recidivism and we would not claim that even those factors which we find to be most highly associated with failure are in any part a cause of such failure. If we show that truancy is associated with recidivism the remedy would not be likely to be found in making truancy impossible. Truancy and recidivism may reflect a common element of some other factor or factors which we so far may have been unable to isolate, describe or measure" (pp. 213–214). The "personality theories" in their extreme form tend to focus their attention on the bio-psychological peculiarities or abnormalities of the individual, while ignoring or disregarding cultural and group influences as conceived by the sociological frame of reference.

At the other extreme of the continuum we find the purely sociological theories which regard crime as a product of association with criminal groups and absorption of criminal values.[2] Between these two extremes there is a vast array of theories which try to synthesise the endogenous and exogenous approaches; among these are the multiple factor and the eclectic theories. The latter may hardly be called a theory, because virtually everything is regarded by its adherents as a criminogenic factor.

It should be pointed out, however, that most of the theories tend to cluster around the two extreme poles, because sociologists invariably regard personality as mostly the product of internalised culture, *i.e.*, the subjective counterpart of culture, whereas the " personality theories " are usually based on the premise that groups and group influences ultimately resolve themselves into problems of degree and quality of individual differences (Vold, 1958). The age-old feud between the two approaches has been highlighted again in a recent article summarising the work of the Gluecks in the field of juvenile delinquency prediction (Glueck, 1960, p. 283). It is not claimed that the dispute between the Gluecks and their sociological " tormentors " engulfs the sum total of controversial points in theoretical criminology; it may serve, however, as a proper illustration to our major argument in the present paper: that disputes in criminological theory are mainly due to the loosely defined boundaries of our subject-matter, to conceptual ambiguity and to overlapping theoretical levels. If this argument is proved to be correct most of the disputes between the " personality " and " cultural " theories in criminology may be deemed unnecessary.

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[1] To name but a few of the expounders of these theories we may mention the neo-Lombrosians: Hooton and Sheldon, Goddard and his followers, who saw the main causes of crime in feeblemindedness; Burt, the Gluecks and the psychoanalysts who attribute criminal behaviour to various defects in the personality structure of the individual.

[2] Sutherland, Cohen, Cloward, and many other American sociologists are the exponents of this extreme approach.

The first major point raised by Professor Glueck (1960, p. 293) against the various sociological hypotheses, especially the late Professor Sutherland's differential association theory, is that to attribute etiologic exclusiveness or priority to cultural factors is to reason in a circle, because the delinquency subculture did not fall from the heavens; it was made and is being sustained by delinquent people. We may point out, however, that it would be equally circular to attribute priority to personal factors over cultural ones when dealing with the etiology of crime on the social level. A clear distinction should therefore be made between the latter, *i.e.*, the overall crime rates in a given community, the phenomena of organised crime, the formation of gangs, etc., and the process (*i.e.*, the " recruiting ") by which a certain individual becomes a criminal or commits a criminal act. Precisely this " recruiting " process is the focus of the controversy, because neither the Gluecks in their prediction methods nor Sutherland in his differential association theory deal with the etiology and phenomena of crime on the social level. If we proceed then to compare these two approaches to crime causation on the personal level, we find that Sutherland (1955, p. 78) attributes the recruiting process, *inter alia*, to an excess of definitions favourable to violation of law over definitions unfavourable to violation of law, whereas Glueck (1960, p. 297) says: " If a boy persists in delinquency, it means that his power of resistance to natural impulse or his desire to obey socio-legal mandates has been over-balanced by the strength of the other circumstances that incline to antisocial behaviour." These two statements seem to convey the same meaning, and if Sutherland's statement is tautological (which is not necessarily worthless for theoretical purposes (Glaser, 1950)) so is Glueck's.

The point is, however, that these two approaches do not contradict but supplement each other, because they operate on different etiological levels, Sutherland tries to describe the final process by which a person becomes delinquent, whereas the Gluecks try to explain why certain boys reach the stage where the process described by Sutherland begins. The latter deals with the question " *How* does delinquency occur? " using the classic etiological design of necessary and sufficient causes, whereas the Gluecks try to tackle the question " *Why* does delinquency occur in terms of probability and association of variables? "

The essence of Sutherland's theory is that crime and delinquency are learned by association with delinquent groups and identification with their values; this association may vary in frequency, duration, priority and intensity with a correspondent variability in the resultant delinquency. Glueck (1960, p. 301) argues, on the other hand, that " Culture . . . plays no role in conduct unless and until it is, as it were, emotionally swallowed, when it becomes part of the motivating force against the taboos and demands of the prevailing culture. This oversight, among others, . . . accounts for the superficiality and puerility of the differential association theory." This part of the criticism is probably based on a misunderstanding. Sutherland (1956) did not mean that crime is caused by mere physical contact with criminal patterns of culture and behaviour, rather did he stress that the absorption of criminal values and their internalisation as personality elements is the major component of his theory. On the other hand, few sociologists (Sutherland followers inclusive) still adhere to the latter's sweeping statement that the " differential association " theory explains the whole volume of crime in a given community, and confine their interest and cultural explanations to systematic organised crime and juvenile gangs.[3]

It seems to us, therefore, that the two main impediments to the task of delineating the boundaries of theoretical criminology are: (1) Merton's argument that crime is not a *sui generis* behavioural entity and is, therefore, not susceptible to etiological analysis; and (2) the superfluous feud between the " personality " and " cultural " theories.

Some Clarifications.

Criminal behaviour results when a legal norm (*i.e.*, the criminal law) is disobeyed. We may formulate, therefore, Merton's argument in the following double hypothesis:

1. Criminal law norms are not intrinsically different from other social norms. The infringement of the former (*i.e.*, crime) is not, therefore, intrinsically different from other social deviations.

2. The violators of criminal laws are not *behaviourally* distinct from law-abiding persons; scientific analysis of law violators as groups or individuals is, therefore, fruitless.

The first part of the hypothesis is bound to be rejected even on the face of it because the criminal law norm is different in kind from other social norms in *the method in which it is liable to be enforced and in the consequences of its enforcement.* The punitive element in the sanction of the legal norm makes the latter a unique social norm which stands on an altogether different level than the norms sanctioned by ridicule, scorn, gossip or even social ostracism. The ritualistic elements in the criminal procedure, the special setting of the courtroom, the necessity to plead guilty or not guilty, the formal conviction, the publicity that ensues, and the stigma of the convict which usually brands him with a permanent mark of Cain make the criminal norm unique. Courts of law are among the most important social institutions in every society. The reaction of most people to a summons to appear in court as a defendant varies from morbid fear to more than a mild excitement. The criminal trial in which violators of legal norms *must* participate (if caught, of course) makes the criminal law norm a unique social norm, irrespective of the severity of sanction specified for the violation of that norm. The extent to which a criminal law norm has been internalised by a certain individual, to become a personality element, and whether the criminal procedure and sanctions are effective means to enforce compliance to the criminal law are irrelevant in the present context. The actual strength of the various legal norms does, of course, differ from one norm or group of norms to the other. This strength is not always dependent on the penalty prescribed for the offence by the legislators but by the public's attitude towards the infringement of the norm. The latter was called by Sellin (1938, p. 42) the " resistance potential " of the norm. The criminal law norms in a certain legal system may thus be graded according to their relative strength.

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[3] See, for instance, Cloward and Ohlin (1960) which summarises and reviews most of the previous work on juvenile delinquency carried out by sociologists in the U.S.

The second part of the hypothesis, *i.e.*, that " criminals " is a " blanket-concept " because they do not have any common denominator which distinguishes them from the rest of the population is definitely true if we study criminals as a separate species of fauna in the old Lombrosian tradition. But modern criminology seems to agree with Reckless (1955) that " Crime in general is too much of a pot-pourri of unconnected behaviours for criminologists or any other behaviour experts to explain *in toto* " and tries to develop theories for restricted and behaviourally distinct segments of crime in a given community. The modern trend is to deal with distinct " behaviour systems," such as the professional thief, the embezzler, the juvenile gang, the drug addict, the prostitute, etc., and not with crime in general. (Cressey, 1953; von Hentig, 1943; Shaw, 1930; Sutherland, 1937).

Probable Solutions

We are in a position now to try to disentangle some of the seemingly insoluble dilemmas in the " personality " v. " cultural " dispute in criminological theory. A relatively defined demarcation of our subject-matter is likely to ensue as a by-product of our following analysis.

It would be useful if we divided our examination of the problem into three stages, *viz.*, the " recruiting " or the process by which a person commits his first offence; the recidivists; and the phenomena of crime on the social level.

1. *The " recruiting "*

The causes of the process by which a person commits his first offence or a child makes his first steps towards delinquency are considered to be the main subject-matter of criminology. The theoretical clarifications, however, of this level of the etiology of crime have been relatively meagre. It has already been pointed out that the *only* approach to the etiology of crime on any level which may lead to comprehensive results is to study offences and offenders as classified according to a common behavioural denominator because to look for the common causes of tax frauds and indecent exposure is not only a practical impossibility but sheer nonsense. (See also Morris, 1955, p. 6.) Another fallacy which hampered the understanding of the " recruiting " process is the insistence of various theorists that crime is either a normal learned behaviour or pathological manifestations of the individual's personality; in other words, crime was either likened to the process of learning a language; or the criminal himself was likened to one who stammers. The fallacy, however, lies in the unjustified assumption that we know how and when certain patterns of culture are absorbed by individuals and that we know how behaviour is influenced by personal traits of the individual. We know neither. These problems are bound to remain for a long time to come the weakest link in the behavioural sciences, the realm of the pseudo-theorists who indulge in formulating hypotheses without the proper means to prove or disprove them. It should be pointed out, however, that the sociological theories do not deal, as a rule, with the " recruiting " process. Glaser (1956, p. 440) tried to close this gap by modifying Sutherland's theory and introducing the concepts of " role-playing " and identification with the criminal images as the major explanation of crime at the " recruiting " level, but he failed to notice that the question to be asked at the recruiting level is: *why* does a person act a criminal role and *why* does he identify himself with criminal images. This question has not been dealt with by Glaser. It should be pointed out that Sutherland had no intention of explaining the " recruiting stage " of crime causation:

he states, *inter alia,* " that (another) procedure for putting order into criminological knowledge is differentiation of levels of analysis. The causal analysis must be held at a particular level . . . For example, it made no difference to the physicist whether a body began to fall because it was dropped from the hand of an experimental physicist or rolled off the edge of a bridge because of vibration caused by a passing vehicle . . . a theoretical statement about criminal behaviour can be made without referring to (these) early factors. By holding the analysis at one level, the early factors are combined with or differentiated from later factors or conditions . . . " (Sutherland and Cressey, 1960, p. 76). Precisely these early factors comprise the " recruiting " level of criminal behaviour.

Short of fully understanding the " recruiting " process, the only adequate substitute (although a poor one) for causal explanations is statistical prediction. It should be stressed, however, that the Gluecks' prognostic devices cannot be regarded as a laudable example of prediction in the present context; first, because their presumably matched " control-group " led them to argue that they are dealing not only with prediction but also with etiology; and, second, because they confined themselves to a relatively small and limited number of variables. These drawbacks are absent, for instance, in the Mannheim-Wilkins and the MMPI prognostic devices. It is our view, however, that prediction of criminality should not be confined to relatively few " reasonable " variables, because if we do not pretend to deal with causality any positive correlation which shows a marked link between certain variables and a given type of crime should be taken into account. It is agreed that a positive correlation between the number of stork nests in a given community and the number of births is definitely spurious, but nobody can blame the pram dealer who renews his stock according to the fluctuations in the number of stork nests—if this correlation has been obstinately consistent throughout the years. Prognostic devices and prediction techniques have been widely criticised,[4] but the crucial point for our present purposes is that criminological prediction might be wrong in so far as it tries to infer from the behaviour of convicted offenders the future behaviour of potential

[4] For a comprehensive analysis of crime prediction and methods, see Wootton (1959).

offenders who are, as yet, non-offenders. The present argument is based not only on the fact that crime prediction is invariably *ex post facto, i.e.*, criminal careers retrospectively examined, but mainly on the hypothesis (which has not as yet been fully tested) that a convicted offender undergoes a marked change in status, both socially and personally, in case his offence and conviction are accompanied by a social stigma. A first offender after his conviction is faced with economic and personal hardship which is bound to influence his social status and role both in his immediate surroundings (job, family, etc.) and in society at large. The adjustment problems which ensue as a direct product of the stigma of conviction may change the behaviour and, to some extent, the personality structure of the offenders. The various prognostic factors may therefore be associated with *convictions* and their social stigma and not with the structural peculiarities of personality which are associated presumably with crime. Diagnosing potential offenders by means of predictive factors extracted from a follow-up of convicted offenders may thus lead to an obvious fallacy. Another fact which may hamper the task of detecting potential recruits to crime is our fragmentary knowledge of the real extent and volume of offences committed in a given community. We do not refer, in the present context, to the common argument that crimes known to the police are only a fraction of the total volume of crime. Rather do we wish to stress the relatively neglected fact that criminology focuses most of its attention on offences committed by persons from a clearly defined social stratum. The perennial interest of criminologists in crimes committed by the lower classes has only recently been widened to law violations by the middle and upper classes. Sutherland (1949) showed that the extent, the volume, the severity and especially the cost of offences committed by corporations, businessmen, politicians, and other " respectable " citizens if compared to the ordinary property offender, turn the latter into a victimised and quite harmless peanut pilferer. Law violations by the middle and upper classes are relatively " unknown to the police " because they are either not reported to the authorities or they get preferential treatment by the machinery of justice which is, in most states, run by the upper and middle classes. This is even more so for the loosely defined field of juvenile delinquency, where behaviour which is branded as delinquent and prosecuted accordingly in a boy from the lower social strata is either not reported, or regarded as plain naughtiness if the boy happens to be from a " good home," *i.e.*, the upper social strata. (See Cloward and Ohlin, 1960, pp. 4 *et seq.*; Kvaraceus and Miller, 1959, pp. 48 *et seq.*)

It follows, then, that if reported law violations are only a fraction of law violations actually committed prognostic devices predicting potential recruits to crime are bound to contain a latent bias because:

(a) They are based on special characteristics displayed by offenders from a relatively defined social stratum which may not be possessed by offenders from different social strata.

(b) They might be a better predictor to the *preferential practices of the machinery of justice* than to potential law violators.

This is even more true concerning the diagnostic practices guided by the extreme " personality " theories which regard crime as invariably caused by mental abnormality. Here we may cite Vold's (1953) apt, but somewhat acid remark that: " If the phenomenon of crooked and dishonest dealing, of which crimes against property represent a small fraction, is interpreted as mental abnormality, this is in effect saying that the entire population is sick and abnormal, except, perhaps, for the few misunderstood psychiatrists so valiantly struggling to stem the tide of all-pervasive misconduct."

2. *The Recidivists*

The offender is " recruited." An offence is committed. The offender is caught, sentenced and branded with the mark of Cain. From here on we cannot employ the tools and methods which were used for the study of the " recruiting " stage of the etiology of crime. It has already been pointed out that a first offender convicted of an offence which carries with it " moral turpitude " (the legal concept for the stigma of crime) has severe adjustment problems and a diminished range of socio-economic opportunities as a direct result of his conviction. It has been recognised that one of the most forceful predictors of recidivism is the past criminal history of the offender, *i.e.*, the number and frequency of his previous convictions. (See Frey, 1954, pp. 326–8; Mannheim and Wilkins, 1955, p. 145; Vold, 1931,

p. 84.) A recent follow-up study[5] of 3,500 offenders sentenced to terms of suspended sentences of imprisonment revealed that failure within the period of the suspended sentence is directly proportional (a high positive correlation) to the number of previous convictions, and a valid prediction device was construed on the basis of this variable and the age of the offender.

The problem of recidivism may be reduced, therefore, to stages of the offender's criminality (based on his criminal history). Stages of criminality may be likened to the spectrum of light, with the reformative stage in the ultra-violet and the preventive stage in the infra-red. In the reformative stage the offender's previous convictions are few and his chances of reformation are good. When the stage of criminality moves along the spectrum toward the red, the waves are more frequent and shorter, until one reaches the scorching infra-red which symbolises the ultimate preventive stage and the offender's incorrigible recidivism (Shoham, 1959). The sociologists admittedly refrained from dealing with the " recruiting " level of the etiology of crime but their tools and methodology are most suitable to the study of the " maturation " process—from the first offender to the persistent and professional one to the incorrigible recidivist. And, indeed, Sutherland (1960, pp. 78 *et seq.*) contributed to the understanding of this process by introducing to criminological theory the learning process and the degree and intensity of association with criminal groups and their values. Cohen (1955, p. 121) applied to the pressure towards delinquency the various sociological theories, dealing with the formation of subcultures, the differential access to the goals open to the various social classes and the criteria for status achievement within the juvenile group.

Cloward and Ohlin (1960, pp. 150 *et seq.*) demonstrated how the relative availability of illegitimate opportunities affects the resolution of adjustment problems leading to persistent delinquency.

However, a major factor enhancing the pressure towards recidivism is relatively neglected by criminological theorists. This factor (or group of factors) is the effect of the offender's clash with the machinery of justice and the resultant social stigma. The importance of this factor is clearly apparent from the high predictive value of even a single previous conviction.[6]

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[5] S. Shoham and M. Sandberg: Suspended Sentences of Imprisonment in Israel. A Report submitted to the Israel Society of Criminology, to be published in *Crime and Delinquency*, June 1963.

Tannenbaum (1938, p. 20) recognised the importance of this factor and almost overrated it by stating that: "The process of making the criminal . . . is a process of tagging, defining, identifying, segregating, describing, emphasising, making conscious and self-conscious; it becomes a way of stimulating, suggesting, emphasising and evolving the very traits that are complained of. If the theory of relation of response to stimulus has any meaning, the entire process of dealing with the young delinquent is mischievous in so far as it identifies him to himself or to the environment as a delinquent person." One of the most important tasks therefore, in the present context is to formulate and test hypotheses as to the relative significance of the stigma of crime to the etiology of recidivism. These hypotheses should deal with the ways in which a conviction may limit a person's socio-economic opportunities, the way his status and role are forcibly changed—the ex-convict's " sour-grapes " rejection of some social norms and his associations with his other ex-convicts who have similar adjustment problems; and finally the total rejection of the norms and values of a society which branded him with the mark of Cain and the acceptance of the norms and values of the criminal group. There he might achieve prominence and brand in turn the society which ostracised him as a " bunch of hypocrites " and its businessmen and politicians as " legitimate racketeers." This attitude is voiced by Daniel Drew [7] who said: " Law is like a cobweb; it is made for flies and the smaller kinds of insects, but lets the big bumblebees break through."

3. *The Social Level*

Theories dealing with the " recruiting " process and the individual offender's way to recidivism are unsuitable for explaining the phenomena of crime on the social level, *i.e.*, the fluctuations of crime rates in a given community for a given time; the genesis and volume of special types of crime, and the phenomena of organised crime.

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[6] In the suspended sentences study the overall rate of " success " of offenders with no previous convictions was 75 per cent., whereas those who had one previous conviction succeeded in 50 per cent. of the cases.

[7] " A pious old fraud " cited by Sutherland in " White Collar Crime " *op. cit.* p. 21.

Here again some unitarian theories have been forwarded to explain the genesis and phenomenology of crime on the social level; these range, to mention but a few, from Marxist theories on the predominance of economic conditions (Bonger, 1916) to the disintegration of the normative systems of modern communities,[8] to Sellin's much adhered to theory on the conflict of conduct norms as a result of social change. It should be pointed out, however, that the unitarian fallacy in criminological theory is even more apparent on the social level than on the individual level; because here a unitarian theory should perform the impossible task of formulating one hypothesis or a group of related hypotheses to encompass such divergent phenomena as the upsurge of criminality during the prohibition era in the U.S. and the criminal tribes in India. The proper approach to the etiology of crime on the social level, and one that is gaining ground in modern criminology, is to classify the phenomena of crime on the social level into relatively limited and clearly defined problems and then to try to formulate theoretical generalisations to fit their limited boundaries.

Some good examples of this approach are afforded by studies such as those of Van Vechten (1941), Sellin (1937), Clinard (1942), Lindesmith (1941), Mannheim (1940), and many others who focused their attention on a relatively narrow and defined aspect of crime on the social level.

It should be stressed, however, that, in order to be comprehensive, theories relating to aspects of crime on the social level should be cross-referred to both the social structure and the normative system. If we deal, for instance, with organised crime in the U.S. it is not enough to stress the fact that American deification of pecuniary success weakens the norms that prescribe legitimate means for "making money," but adequate attention should be paid to the possible link between the political organisation of some states in the U.S. and the unique phenomenon of the American "racket." Then the study of crimes of violence in Sicily in the early decades of this century may indeed be linked with cultural traditions of the population or parts thereof to resort to violence while solving disputes, but a study of the social structure should also be made in order to reveal whether it enhanced or tolerated the rise of the Mafia organisation.

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[8] The chief exponents of these theories are Durkheim (1951); Merton (1957) and their followers.

The exclusive reliance on defects of the normative system (anomie, culture conflict, etc.) for explaining crime phenomena on the social level might be inadequate on other grounds: it usually reaches a very high level of abstraction and it is very difficult to trace it down to the actual phenomena.

In Israel, for instance, an acute " anomic " process is operating in full force (Talmon, 1961) and there is also a marked upsurge in the overall rates of many types of crime including traffic offences and emblezzlement, but the possibility of finding direct links between the anomic process and the crime rates is sadly remote. This " disconnectedness " between theory and fact befits more a mystic than a scientist (Glaser, 1956). Then the criminality of immigrants in Israel may be explained, *inter alia*, by the conflict between the conduct norms prevailing in the immigrants' countries of origin and laws in force in Israel; but the culture-conflict hypothesis cannot be artificially stretched to explain the crime-rates of the receiving community which absorbs the immigrants. It should also be pointed out that the interrelation between the legal norms and the other conduct norms prevailing in a given community should be studied in conjunction with the various types of crime; it is certainly necessary to establish the attitude of the community towards the infringement of a certain legal norm (*i.e.*, the legal norm's resistance potential (Sellin, 1938) before studying the rates of this specific offence. But this may not be enough. The "resistance potential," for instance, of the prohibition laws in the U.S. was admittedly very low, and this may account for the high rate of prohibition offences; but a community of very strict sexual mores may not necessarily have a low rate of prostitution. Victorian England might afford a negative proof of this hypothesis.

We may state in conclusion that the sociological theories concerning the normative system of society and social change may indeed be fruitfully applied to the etiology of crime on the social level; provided they are not kept at a high level of abstraction and the theories are adequately matched with their corresponding facts.

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EPILEPSY AND CRIMINALITY*

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WHEN considering papers dated years ago concerning particular manifestations of epilepsy or the behaviour of epileptics, the question should always be asked (unless the data reported preclude all doubt): Are these actually cases of epilepsy? The criteria adopted in establishing a clinical diagnosis were presumably at times different from the criteria used currently and, until the Second World War, our main diagnostic aid, electroencephalography, had to be dispensed with. Another point that should be taken into consideration is the fact that epilepsy probably frequently ran another course and gave rise to manifestations differing from those observed today, owing to the fact that until 1912, the year in which phenobarbital (luminal) first made its appearance, no anti-epileptic medication of any note was used.

The above should be borne in mind when it is realised that epilepsy had acquired a questionable reputation among those engaged in the practice of legal medicine, a reputation at variance with current experience, including the author's own findings. Serious aggressive acts of great violence, severe sexual offences and arson were imputed to epileptics and yet, if the present author or a fellow practitioner experienced in this field were to be asked to enumerate the serious offences committed by epileptics he has encountered, he would probably soon have finished his list.

Let us examine which states of mental disorder may give rise to or constitute a background for offences in epileptics. These conditions may be " chronic," *i.e.*, also interictal, occurring between attacks, or they may occur ictally, *i.e.*, during seizures. In addition there is the psychopathological episode that, in certain patients, occurs post-ictally, that is to say after one or several, usually generalised, seizures. In the latter state, in which the degree of consciousness tends to be reduced, the patient may become aggressive and dangerous. As a rule he will be incapable of committing an offence requiring some form of planning. More or less co-ordinated and sometimes apparently purposeful acts are more likely to occur in the so-called twilight states that are attacks in themselves; namely, prolonged psychomotor seizures (or post-ictal phenomena in psychomotor epilepsy) and attacks of a prolonged " petit mal " status. The well-known cases reported in the literature, in which the patient makes a long journey by train or ship and, for example, having started from Paris, " comes to himself " again in Ceylon, but has complete amnesia for the intervening weeks, can perhaps sometimes be classified in one of these groups. These case reports, too, usually date from the time preceding the advent of modern knowledge of epilepsy and today the question may be raised whether these were not frequently conditions other than epileptic episodes. Nowadays, however, twilight states persisting for several days or even for weeks are still observed. The Marseilles school particularly stresses the role of psychomotor epilepsy in these conditions. Gastaut *et al.* (1956) reported the case of a woman who wandered about the countryside for more than three weeks in such a state, asking for water in hamlets and sleeping in thickets. In a study of 1,138 epileptics, we (Lorentz de Haas and Magnus, 1958) were particularly struck by the relative frequency of the twilight states which are caused by a " petit mal " status. The offences committed in this last type of twilight state, during which the patient is capable of performing such acts as walking, cycling, setting the table, etc., are no more serious than, for instance, ignoring a traffic signal. Patients do *not* tend to be aggressive in this condition.

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Patients in a psychomotor, ictal or post-ictal, twilight state, on the other hand, can become extremely aggressive and dangerous. As a rule, however, aggression will only result when an attempt is made to stop the patient from walking about in a disorientated state of mind. It is not likely that these conditions will frequently account for an offence committed by a patient not previously known to have been an epileptic. These twilight states usually are of brief duration. Many patients regularly subject to these states and to accompanying aggressive tendencies will remain inmates of hospitals for epileptics or mental hospitals. Finally, it has been the experience of the present author in dealing with a large number of cases of epilepsy, that these states very rarely occur inside, no more than outside, the hospital. For a differentiation of psychopathological episodes in epileptics, the reader is referred to the elaborated results of the Colloquy held in Marseilles from October 15 to 19, 1956 (Dongier, 1960) as well as to Marchand and de Ajuriaguerra (1948).

We now come to the inter-ictal " chronic " conditions that might be promotive or causative factors in criminality. " Epileptic " personality changes which, however, are confined to a minority of epileptics, might be classified as follows:

1. Changes of this type secondary to organic lesions of the brain appearing during the course of the disease and possibly due to transient cerebral hypoxia, especially if this recurs at frequent intervals.
2. Reactive mental or neurotic responses to the state of being ill and the resulting social situation of the patient, etc.
3. Character disorders appearing as a parallel symptom to the epilepsy owing to a congenital or an acquired brain injury.
4. The possibility of an inter-ictal episodic functional condition, manifesting itself in disturbances in behaviour, whether attended or not by anomalies in the EEG—also in epileptic patients without mental impairment—should be considered as well.

Sub 1. Epileptic dementia and the main personality disorders, at any rate those of long-term patients cared for in colonies, are included in this group. Although the brain lesion caused by a deficient supply of oxygen cannot in itself be regarded as specific for epilepsy, it is possible that this " experiment " of epileptic hypoxia in comparison with other conditions which might produce similar lesions by an identical mechanism is on a scale so large as to suggest incorrectly that the resulting personality changes are specific of epilepsy.

Sub 2. Some investigators claim that this is the main or even the sole origin of the personality disorders in epileptics. In the opinion of the present author, this view is incorrect and due to what might be called " over-objectivity " in regard to epileptics and the reputation which at least a number of these patients have of showing certain personality disorders.

Sub 3. Accordingly, this is a heterogeneous group of factors causing injury to the brain. Some investigators are of the opinion that the previous character of a patient suffering from brain injury plays a predominant part in his personality disorder (Pond, 1961).

Naturally, the causes stated under (1) and (2), those stated under (2) and (3), those stated under (1) and (3), and those stated under (1), (2) and (3) may appear simultaneously in a single patient. We also know that the character disorders of these patients, however rooted they may be in these groups of causes, include social maladjustment, intolerance, irritability and aggressiveness. Of the total number of epileptics in the population, however, only a small proportion will be affected by these character disorders and this small number will include only a few patients in whom these disorders, aggressiveness in particular, will increase to the point of resulting in (impulsive) offences such as manslaughter.

Sub 4. In this case one could imagine " sub-ictal " symptoms, to be compared with similar symptoms provoked in cats by electrical stimulation in experiments conducted by Buchwald and Ervin (1957).

These then are disturbances in the cerebral equilibrium related to epilepsy, which, however, remain below a certain level, so that there is no clinical attack. In this connection the results as regards the behaviour obtained by temporal lobectomy in patients with discrete focal temporal lesions are also of importance. I am, however, of the opinion that the possibility of psychic anomalies presenting themselves in man on a sub-ictal basis has not yet been sufficiently investigated. There are no indications that on this basis criminal offences are committed by epileptics on any significant scale. See, for instance, the results of the investigation by Alström (1950), who showed that the incidence of criminal offences among epileptics did not differ significantly from that among the average population. This was true at any rate of the mentally unchanged patients. Criminal acts were slightly more common among the mentally changed patients than they were among the average population. Heinous crimes were not committed by the subjects studied. Theft and burglary were the most common offences.

Entirely different results were obtained in a recent investigation concerned with a fairly small number of male patients and carried out in North Carolina, U.S.A. (Wilson, Stewart and Parker, 1960). A considerable number of patients were found to have court records. Aggressiveness was a prominent feature in these cases. The patients must have been exceptional in that the average IQ was about eighty-eight.

All things considered, there is probably good reason for assuming that the legal problem created by the epileptic with character disorders should be regarded mainly as that of a patient with cerebral defects due to organic causes. It is only true to a very limited extent that the legal problem created by the epileptic is such as to merit special attention.

Patients committing an offence during an ictal episode are the most characteristic subjects from the point of view of epilepsy. In such cases, however, the offender will usually be known already to be an epileptic and, if this should not be so, the concomitant circumstances will be so clearly indicative of a medically unusual condition that an expert will seldom have any difficulty in establishing the diagnosis, especially if aided by electroencephalography. The patient whose initial epileptic manifestation consists of a psychopathological episode during which an offence is committed continues, however, to be a complicating factor, especially when this state is marked by carefully planned and ordered conduct and, in addition, as sometimes happens, there is only an incomplete amnesia for this period.

From a historical point of view, there are *two trends* which have promoted the making of a criminological issue out of epilepsy.

The *earlier trend* has its origin in that clinical and neurophysiological facts have been abandoned for the development of theories based on analogies and speculation. As a result of this concluding from analogies, terms such as epileptic personality, epileptoid state, etc., have been used to define individuals showing certain personality traits which *may* also occur in epileptics.

Drawing conclusions from speculations has led, for example, to the belief that generalised epileptic seizures as well as the form these seizures take are phenomena of solely mental origin (*cf. inter al.* Schilder, 1925). There is so little need to take this seriously that it is unnecessary to go to the trouble of refuting this theory. It is merely recorded as a matter of curiosity. The " analogies " idea deserves more attention, as this is a point of view and a concept that has become planted as a reality in the minds of many psychiatrists. Therefore, we wish to stress again the fact that the cerebral lesions which usually cause the personality changes in these patients are not truly specific. Moreover, we also see no reason for describing as " epileptic " individuals showing none of the clinical symptoms of epilepsy, save possible paroxysmal behaviour disorders or psychopathological episodes, unless the electroencephalogram provides evidence for specific epileptic activity.

At the same time this brings us to the *second point*: when changes in the electroencephalogram are observed in subjects showing behaviour disturbances, these individuals are repeatedly and immediately classified as epileptics. In the early days of clinical electroencephalography, Hill (1944) had already pointed out that cerebral dysrhythmia occurs in a number of psychopaths as well as in epileptics. In the opinion of the present author, however, there is no justification for assuming any further relationship between this group of psychopaths and epileptics. Frankenstein (1959), for example, in this connection states that relatives of epileptics whose electroencephalograms are characterised by cerebral dysrhythmia need not necessarily show "epileptic" behaviour patterns. Moreover, there are all sorts of organic and functional cerebral disturbances marked by changes in the electroencephalogram and, on the other hand, the forms of dysrhythmia shown by epileptics are frequently of a very particular character and even vary with different clinical manifestations of epilepsy.

Though publications such as that of Hill (1944), drew attention to interesting possibilities, they have, on the other hand, caused a large number of inmates of reformatory schools, prisons, etc., when changes have been observed in their electroencephalograms, to be referred to physicians engaged in the treatment of epilepsy, the question being put whether the abnormal behaviour or the offence should be regarded as "epileptic" in such a case. These referrals are probably also motivated by the gladness felt by those having pupils, offenders or patients in their custody when the findings have yielded something of an objective nature, something tangible that may possibly enable a therapeutic approach. Unfortunately, it is frequently very difficult to exert any medical effect on behaviour disorders, even *when* the patients showing these disorders are genuine epileptics. There is even some antagonism between seizures and behaviour disturbances; when the former are suppressed, it is repeatedly seen that the latter increase. Besides, Landolt (1955) drew attention to the remarkable phenomenon of "forced normalisation": when the electroencephalogram returns to normal as the result of medical treatment, mental disorders may increase or even appear for the first time. Likewise, the operations that are sometimes performed for psychomotor epilepsy may not yield improvement of behaviour disorders or result in aggravation of these disturbances. It cannot be denied, however, that there are other epileptics for whom medical or surgical treatment not only has a beneficial effect on the seizures, but also on the behaviour and adjustment (Hill *et al.*, 1957). In these cases, the value of the secondary psychological effect on the patient who now has few, if any, seizures should not be left out of account.

At the end of this general survey on the possible relations between epilepsy and criminality, the present author would draw the following conclusions:

1. When there is any ground for assuming that the individual committing an offence is an epileptic, the problem should be referred to a neurologist or neuro-psychiatrist specialising in the field of epilepsy. This specialist will then be able:
    (a) to establish the diagnosis;
    (b) to decide to what extent he believes a relationship exists between the offence and an ictal or post-ictal psychopathological episode in the event of epilepsy;
    (c) to consider whether there is any relationship between the offence and any abnormal personality structure that may be present inter-ictally in the event of epilepsy.

In this last instance the additional considerations will usually be similar to those in other cerebral lesions due to organic causes, forms of feeble-mindedness, and dementia.

Especially in an epileptic without mental deterioration we should have to consider finally the possibility of a " sub-ictal " condition. It would probably be exceptional for such a condition to give rise to a criminal offence. This possibility must, however, remain a subject of study. The final point is the influence of epilepsy as a mental trauma in the life story of the delinquent.

2. It is not claimed that the frequency of aggressive manifestations in epileptics would not be higher than in non-epileptic individuals in the total population, nor that such a manifestation would never take the shape of a serious offence. That which is stressed is the following:
    (a) Such aggressiveness will mostly be found in epileptic patients with mental deterioration. In these cases there is actually no question of a *specific* relation between epilepsy and offence, even if this mental deterioration is a result of cerebral hypoxia caused by epileptic seizures.
    (b) Experience gained in recent times, which have offered possibilities of more exact diagnosing of epilepsy with the aid of electroencephalography, shows that serious criminal offences are not found appreciably more often in epileptics than in the average population.

So the problem of " epilepsy as a factor in crime " ought to be reduced to its true proportions. The matter should be regarded as a medical, psychiatric and neurological, occasionally legal, problem of great interest in itself, but mainly within the scope of casuistics, rather than as a criminological problem of vital importance.

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PENAL THEORY, PENAL REFORM AND BORSTAL PRACTICE

AN EXAMPLE OF PRESCIENCE?

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BECAUSE the penal system is varied, penal reform has many aspects and it is over-simplification to state that the main attention of reformers has been focused on one aspect of this field. However, one of the main areas of concern and achievement of reformers between 1900 and the present day has been to keep offenders out of prison and other institutions. For a variety of reasons reformers have advocated the development and extensive use of non-institutional means of dealing with offenders. The development of the probation service is one example of this movement, another being the various laws enabling the courts to give offenders time to pay their fines. A further development has been the extensive creation of special institutions (approved schools, borstals, detention centres) all having as part of their aim the prevention of young offenders being sent to prison. Finally, legislation has been passed restricting the court's choice of prison as a sentence for both young offenders and first offenders.

One of the results of this has been the partial neglect by reformers, both lay and professional, of reform of the prisons as a penal device. This neglect is in the process of being corrected at the moment. The publication of a Government White Paper [1] and the appearance of three books (Jones 1958, Klare 1960, Howard 1960) on the subject of prison reform all indicate a renewal of interest in the subject.

A short advocacy of reform can be found in a recent article by Gresham Sykes (1960) who argues that " enlightened penologists

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[1] *Penal Practice in a Changing Society*, H.M.S.O., 1959.

of today can recommend a minimum programme of penal reform with some assurance." The purpose of this paper is to summarise briefly the " minimum programme " recommended, argue that much of this is already Borstal practice, and suggest that the success or failure of this practice is a challenge to the " assurance " with which penologists are advocating penal reform.

In a footnote to his article Sykes summarises the " minimum programme " that " enlightened penologists of today " are likely to recommend. Sykes writes that there are nine points to this programme: " a) a greater variety of institutions designed to handle specific types of prisoners; b) small institutions to provide a greater degree of individual treatment; c) a system of home leave to provide for the prisoner's gradual re-entry into the life of the free community; d) provisions for family visits; e) improved social and psychiatric counselling; f) better trained and better paid staff; g) an improved work programme including provisions for higher inmate wages; h) a greater use of parole or probation along with improvement of parole and probation facilities; and i) more rational sentencing procedure."

To these points none of the writers referred to earlier would object, although all would add further items, and, as Sykes notes, all of them " were cited in the English White Paper on Penal Practice." Their limitation is that they do not include all aspects of an institutional sentence which the critics and reformers would want to examine. Any discussion of institutional reform must cover five aspects of an institutional sentence: the sentence itself, allocation-classification, institutional facilities, discharge, and after-care. My aim is to consider ways in which reformers have argued how prison sentence should be reformed under these five headings.

Sentence

Most critics are concerned with two inter-related problems of a prison or institutional sentence—its length and the grounds on which (and by whom) the sentence is selected. Many reformers

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[2] See, for example, two broadcasts reported in *The Listener*, June 21 and 28, 1962, by Michael Argyle and by Nigel Walker, and one by Rupert Cross published in *The Listener*, February 15, 1962.

have commented unfavourably upon the disparity between the time necessary to train an offender (the International Labour Organisation thought one year was desirable and six months the minimum) and the sentence most frequently passed by the courts (for example, in England two-thirds of sentences to prison are of less than six months). One aspect of reform is therefore the length of the sentence itself; reformers have advocated both longer sentences and elimination of short terms of imprisonment. (See, for example, Mannheim, 1955).

A more general discussion of the sentence is the ground upon which the discussion is made, and the individual or organisation that makes this decision. More specifically, many have advocated the reduction of the court and judicial contribution to this discussion and that an increasing contribution should be made by the psychologist and the psychiatrist.[3] One form of recommendation has been the establishment of special sentencing or treatment tribunals for this purpose. (Nyquist, 1960; Home Office, 1960a and 1961.) Another recommendation would be for the staff of penal institutions to have an increased say in the suitability of an offender for an institutional sentence.

Two areas of reform exist in connection with the sentence: the length of the sentence itself, and the body which selects the sentence and its justification for doing so. Reformers see a need to increase the length of institutional sentences, to use the training needs of the offender as the major criterion for length and to give a greater say to the penal worker in selecting the offender suitable for institutional training.

Allocation-Classification

The second concern of reformers is that prior to the process of institutional treatment or training of an offender the staff of these institutions should have at their disposal an assessment of each offender made by experts in each of the social sciences concerned with therapy and training. In a word, each offender must be diagnosed, his needs determined and his capacities assessed. Howard (1960) argues that the first requirement of any rational penal policy is "adequate diagnosis": Jones (1958) stresses the need of " an indoctrination period " during which an assessment of the offender can be made. Both are emphasizing the need for knowledge not simply to enable prison administrators to classify their charges into consistent containment categories but, more important, to enable the assessment of the training needs of each offender. (For a discussion of the problem of allocation see Mannheim and Spencer, 1950.)

Institutional Facilities

Probably the most frequent subject of comment in penal reform is the reform of the institutional facilities themselves, their buildings, size, staffing and régime. Everyone looking at present facilities in the United Kingdom is agreed that a building programme is an imperative need; reformers emphasise the overcrowding and insanitary nature of existing buildings, and also the depressing squalor of nineteenth century maximum security prisons. (Morris, 1962.) In particular, reformers have advocated a change in the size of institutions. Howard, for example, asks that there should be " no more large institutions." Jones argues that new institutions should be of " moderate size . . . say 250." Finally, Klare (1960) suggests the establishment of an experimental prison of no more than 150 inmates. All agree that existing institutions are too large, and their size must be reduced considerably in any reformed system.

The second main area of reform in institutional facilities is their staffing. It is uniformly considered that there is a need for more staffing in general and that staff should be adequately trained. Most reformers make a distinction between the custodial staff and the specialised or training staff. Both types are in demand, but adequate training is a more urgent need for the custodial and adequate numbers for the training staffs. Reformers emphasise the need for adequate psychological, educational and vocational staff. Jones comments that " trained workers in this field are very scarce in relation to the demand for them." Klare advocates that his experimental institution of 150 inmates should have a psychologist, a tutor organiser and a social worker, in addition to the custodial staff.

Training for the custodial staff is also recommended. Howard contends that " prison officers need, in the future, to be given a training which makes the understanding of human behavioural difficulties the central focus of all their work." For Jones " our chief concern " should be " the ordinary prison officer, doing the job on the shop floor." The modern prison officer, he argues, must be capable of " raising the general level of reformative work in the institution." In order to achieve this aim, further training is essential. Klare sees this to be the chief problem of existing institutions and devotes several chapters of his book to this problem and its solution.

A further problem demanding immediate attention is the work programme. Jones states that " in particular the problem of arranging a satisfactory work programme, in the face of existing unions and employer attitudes, must be tackled." The problem, he argues, " is not only one of the kind of work available for prisoners to do, but also of the amount." A régime in which 40 per cent. of the population are engaged in " low grade work " for " about one half of a normal working day " is unlikely to be reformative. These points are echoed by Howard when he says that " the work given to men in prison should be of a character that will not interfere with the definitely rehabilitative aspects of their training, and it should also be work which a man can do without loss of self respect." Finally, Klare suggests that an experimental institution of 150 prisoners should be established and a work programme should include the following industrial training schemes: carpentry, tailoring, brush-making, book-binding, boot repairs and laundry.

One further sphere of institutional life has been given some attention, the recreational. Jones suggests that " a prisoner's work, educational and leisure time activity would all enter into the picture, but not only as they do at present, as a way of passing time, or capturing the interest of the prisoners, or providing them with occupation for employment after discharge." He envisages a wider role, " regaining of social experience and the building of character."

Discharge and After-Care

The final area in which reform is advocated is in the discharge practice of penal institutions. Most reformers are at pains to demonstrate that the sudden change from conditions of captivity to freedom cannot be made without some help or support. Jones recommends the improvement and enlargement of existing after-care facilities and the development of the idea of a " conditional release " for special types of prisoners. Klare gives a whole chapter to " The Way Back " in which he argues the case for the integration of institutional treatment and after-care. Freedom should be given gradually, the prison sentence should be a series of stages, each stage carrying greater privileges, responsibility and freedom. Release would be given when the offender is ready for it and it should be a gradual process. (Morris, 1960; Pakenham-Thompson Committee, 1961.)

The Reformed Institution

From this analysis of the programme suggested for reform, a simple description of a reformed prison system can be made. Inmates should be sentenced to the institution for a period long enough for them to benefit from the training programme, and before sentence some attempt should be made to assess the offender's suitability for training, in particular his need for, and capacity to benefit from, training. During the early part of the sentence a detailed diagnosis of the offender should be made in order to prescribe a treatment programme for him and to allocate him to the institution in which he is most likely to receive this programme of treatment. Institutions themselves should be small and adequately staffed with both trained custodians and with a variety of treatment and training workers. The work programme should be varied and the recreation programme demanding and rewarding. Progress towards release should be by a series of stages, each bringing with it increased freedom, and throughout the sentence, contacts with the free world should be maintained. Finally, the after-care services should be integrated with the training programme of the institution and should be adequate to assist the offender with his problems on release.

In general terms this is what a reformed institutional system should look like. My contention is that the existing Borstal system corresponds closely to the reformed penal system, and one test of the likely success of reforms advocated would be the relative success of the existing Borstal system. The four categories of sentence, allocation-classification, institutional facilities, and discharge and after-care, will be used to describe the existing Borstal system. All comments on the Borstal system relate to the situation prior to the end of 1960.

Borstal Sentence

Two points are important about the Borstal sentence. First, it is indefinite: the sentence is one of four years of which no more than three can be spent in an institution, the remainder being a period of after-care.[3] The minimum time spent in the institution is nine months. Each offender spends between nine months and three years in the institution, the actual length depending upon the staff's assessment of his needs, potential and response to training. The essential point is that all offenders spend sufficient time in the institution to be trained, and the actual length is determined by the individual's needs. Secondly, the sentence is passed only after the court is satisfied " having regard to his character and previous conduct, and to the circumstances of his offence, that it is expedient for his reformation and the prevention of crime that he should undergo a period of training in a Borstal institution." Further, the sentence can only be passed after the court has considered the report by the Prison Commissioner of the " offender's physical and mental condition and his suitability for the sentence." (Both quotations are taken from Fox (1952, pp. 352–353) and describes the statutory basis of a Borstal sentence.) Therefore, on both levels described earlier, the Borstal system can claim to be reformed: its sentence is long enough to train the offender, and before passing sentence the offender's needs must be considered and the prison service's views discovered. Finally, the actual length of the sentence is decided (within limits set by law) by the staff at the training institution. They decide when the individual is ready for discharge.

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[3] The Criminal Justice Act, 1961, made the institutional sentence six months to two years, followed by two years after-care. This does not substantially change the argument in this paper.

Allocation-Classification[4]

As soon as possible after a sentence of Borstal training has been passed, the offender is transferred from the local prison in which he has been remanded and is sent to one of the Borstal allocation centres. The function of these centres is summarised by Morrison as being the " investigation and diagnosis, the preparation of a lad for his coming training, allocation itself, reporting to training Borstals and to the pre-discharge section of After-Care . . . [and] the provision of certain treatment hypotheses which are tested out and modified where necessary by the experience gained during a lad's training and resettlement." Normally the offender spends between four and six weeks at the allocation centre during which time he has " psychological and educational testing, a practical check-up on his vocational skills and interests, interview with a social worker and possibly a visit by her to his home, observation and further interviews by housemasters, and psychologist with referral to the doctor on any relevant medical matter and screening by the psychologist for specialist investigation of any psychiatric problem. . . ."

The second requirement of a reformed system was that the early part of an institutional sentence should be spent at a special centre, in which lengthy and detailed examinations should be conducted in order that an adequate diagnosis of the offender be made and so that he can be sent to an institution most suited to his particular case. The investigations conducted in the Borstal allocation centre would appear to be satisfactory on all of these counts, and again therefore the system can be considered to be reformed.

Institutional Facilities

Most reformers have stressed the need for new prison buildings; in particular they have emphasised the need for the development of buildings much smaller and more varied than the present institutions. The Borstal system is fortunate in that it has a wide range of institutions all of which are small. The 1959 Report of the Commissioners for Prisons lists twenty-three institutions for a daily average population of 4,034 inmates; an average of approximately 180 per institution. Of these institutions, two are allocation centres, one a recall centre for discharged offenders whose licences have been revoked, and one a punishment centre serving the remaining nineteen training institutions. Training institutions differ considerably in their size (the smallest has seventy-four inmates, the largest 364), in their security (ten are closed Borstals and nine open), and in their training programmes. Allocation of inmates is therefore a two-sided problem, one side assessing the inmate's need and potentialities, the other deciding the particular institution in which these needs can best be met and potentialities realised.

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[4] See Morrison (1957) for a description of the aims of procedures of allocation by a psychologist at the allocation centre. All quotations in this section are taken from this article.

The Borstal system would appear to be reformed in that it has diverse institutional facilities, and most of these institutions are small. Further, it is possible to differentiate institutions by their security, training programmes, etc. Because of this it is possible in the allocation centres not only to make a diagnosis of each offender, but also to send different types of offenders to different types of institutions. In the words used by Mannheim and Spencer (1950), Borstal classification is " external " to the institution; further " internal " allocation also takes place within institutions.

The second sphere in which reform has been advocated is in the staffing of the institutions. Two types of staff were distinguished earlier, custodial and therapeutic. Although by no means a perfect distinction, it is a useful one. Reformers have stressed the need for therapeutic or training staff of three sorts, psychological, educational-recreational, and vocational.

The weakest aspect of Borstal training is the psychological and psychiatric staffing. Three training institutions have resident doctors and psychiatrists, and several have visiting psychiatrists and clinical psychologists. The demands made by reformers like Klare for a social worker, psychologist and psychiatrist in every institution are not satisfied by Borstal practice. However, this limitation is being partially offset by two aspects of the Borstal system:

(a) The allocation of more seriously disturbed psychological cases to two specific institutions in the system, both of which specialise in these cases and have attendant and visiting psychological and psychiatric staff. But even in these institutions therapeutic staff are not available in sufficient numbers to cope with the treatment needs of the inmate population.

(b) Within all institutions attempts are made to sensitise all levels of Borstal staff to the idea of psychological treatment. In particular the position of housemaster is of critical importance in this sphere. Recruited from universities, from officers in the armed services, etc., these men are increasingly active as social workers and offer inmates a certain level of " psychological advice and treatment." (See Conrad (1960) for a discussion of the training and role of the housemaster. In this context the rapid expansion of " group counselling " in Borstal is important; see Reports of the Prison Commissioners, 1959–60–61 on this subject, and N. Bishop (1960).)

Part of a shortage of psychological workers is therefore overcome by the process of classification and by the position of the housemaster. But neither of these are adequate substitutes for an increase in the numbers of trained psychological and psychiatric staff. In fact it is on this level, the availability and amount of psychiatric treatment, that the argument that the Borstal system is a completely reformed penal system breaks down, although the practice of " group counselling " throughout the system may do much to offset this weakness.

Against the apparent failure of the Borstal system on the level of psychological treatment must be set the success in recruiting other levels of " training staff," educational and vocational. Formal education is a compulsory part of Borstal training. To carry out this aspect of training the system has twelve full-time and ten part-time tutor-organisers, their time being spent in a mixture of teaching and administration. Much of the actual teaching is done by 400 professional teachers provided by the local education authority who teach in the evenings at the Borstal institutions. Classes are held four or five evenings a week, and most inmates attend two or more nights a week. In addition special classes are held during the day for illiterate and semi-literate inmates. It is the aim of these classes that every inmate should have a reading age of ten years; once this is achieved, the inmate takes his place in other educational classes.

The second level of training in which the Borstal system can claim to be successful is vocational training. Sixteen different vocational skills were being taught in seventy-seven different classes in 1959. Of the average daily population in 1955, one out of five would be engaged on a vocational course, and during that year 1,731 inmates (roughly half the population) took part in the vocational training course. In addition to inmates actually on vocational training and industrial training courses, approximately one-third of the Borstal working population is engaged upon manufacturing work and work services; in most cases these are activities that follow the successful completion of a vocational training course.

Allocation of the inmate to the course is made at the training institution, based in part on the assessment made at the allocation centre by the educational and vocational psychologist. In addition, the inmate's own inclinations are considered, as is the staff's assessment of the inmate's responses to the institution and its work programme.

Some assessment of the relative success of these courses may be gained by the fact that, in 1959, 1,000 inmates were entered for an internal examination on these courses and 87 per cent. passed. One hundred and fifteen inmates were entered for an external examination, *e.g.*, the General Certificate of Education, City and Guilds, etc., and of these seventy-one were successful.

Reformers have emphasised the need not only for adequate work training facilities but also for an assurance that inmates should work a full eight hours a day on work which is both productive and engrossing. Most critics comment unfavourably on the fact that two-thirds of the prison population are engaged on the infamous prison chores of mail-bag sewing, the breakdown of mattresses and mats, and the salvage and sorting of obsolete equipment. One aspect of Borstal training emphasised by the administration is the need for inmates to work a full and hard day, and this is probably successfully achieved. Some attempt is made to use even monotonous and menial work for reform. As the Commissioners (1959) themselves say, " the aim of labouring and domestic parties is to instil the habit of work and the right attitude to work that may be absent." However, it is a minority of the inmates that are engaged in such work, and all inmates have the opportunity, if they have the capacity, to undertake one of the vocational courses mentioned earlier.

The Borstal system would appear to be reformed in that it is made up of a number of small institutions each differing from the other in the type of inmate it was designed for, in its security, staffing and training régimes. Further, attempts have successfully been made in the system to introduce trained and specialised staff. The security staff receive a period of training at the Imperial Training School, Wakefield, and senior staff (assistant governors and above) receive a longer and more varied system of training. Attempts are made to recruit into the Borstal system, on all levels, men who by character, training, experience and inclination are likely to have a reformative influence on the inmate. Finally, specialist training is given through various vocational and industrial training courses and through the educational services (under which heading the varied physical educational programme must be remembered).

The one aspect of Borstal training still largely understaffed and unreformed is the psychological services. However, ways have been discussed in which the impact of even these inadequate services can be minimised. But it remains a major aspect of the Borstal system that requires further reform.

After-Care

Four points about Borstal after-care are extremely important: it is compulsory, it is integrated with the training period, it lasts, since 1961, for two years following discharge from the institution, and it is supervised by social workers.

The Borstal sentence can be divided into two parts, the institutional and the after-care; the length of the latter has throughout the 1950's been at least twelve months and in most cases was very much longer. The average length of Borstal institutional training in 1959 was less than seventeen months [5] and because the difference between time actually spent in the institution and the four-year maximum of institutional training and after-care is spent on licence (*i.e.*, under after-care supervision), the average period of after-care was around two and a half years.

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[5] See para. 8, p. 79, Report of the Commissioners for Prisons, 1959, Cmnd. 1117.

After-care is therefore both compulsory and lengthy: further, it is integrated with training. The contact between the training institution and the after-care authority starts while the offender is in the allocation centre, when full details of the centre's report are forwarded to the Borstal After-care Association. One of the Association's officers visits the offender at his training institution during the early part of his training. At this interview tentative decisions are made about where the young man will live when he is discharged, his likely employment, etc. An after-care supervisor is appointed, and the offender and his supervisor meet while the offender is on his home leave (a five-day leave granted by the authorities to enable the offender to return to his home during the latter part of his institutional sentence and make arrangements for work, etc., on his discharge). Finally, the offender is seen again by an officer of the Borstal After-care Association in the last months of his sentence, to discover if any special arrangements are necessary for his after-care.

Throughout the training period the Borstal Association and the training Borstal are in close and continual contact about each inmate. Inmates themselves have met with an officer of the Borstal After-care Association and his case supervisor. Throughout his training the boy is made aware of the fact that after-care is part of his training, and to ease the problems of discharge, inmates are encouraged, through frequent letters and open visits, to maintain contact with their families.

Finally, the after-care supervisor is a social worker. The bulk of the supervision of Borstal discharges is carried out by probation officers, increasing numbers of whom are trained for social work, all of whom have wide experience of the problems and difficulties of delinquents. Further, these supervisors have great power over delinquents: licences can be revoked if the offender breaks any of the conditions of his licence, and these include unco-operativeness towards his supervisor. Revocation of the licence means that the offender is recalled to Borstal and spends a further period (usually six months) at the Borstal recall centre. Therefore, not only is the supervisor a person of experience and training in this field, but he also has legislative powers over the offender.

After-care is therefore an integral and important part of the Borstal sentence. All discharges experience it and have as supervisors trained and experienced social workers. Like most other aspects of Borstal, the after-care service can be considered to be reformed using as criteria of reform the recommendations of current institutional reformers.

Therefore, with only one reservation (psychological staffing and treatment) the Borstal system appears already to have implemented the reforms discussed by recent writers. The success or failure of this reformed system might well suggest the likely impact of introducing similar reforms in other types of institutions on the conduct of inmates discharged from these institutions. In particular, comparison between the success rates of Borstal discharges with the success rates of the same age group in less reformed penal institutions might well illustrate the impact of this reform. Because not all sixteen to twenty-one year olds are sentenced to Borstal training, but some receive a straight prison sentence, we can compare the success rate of the reformed with the relatively unreformed. Success for this purpose is taken to be not re-appearing in court and information is taken from the Report of the Commissioners for Prisons, 1959, Cmnd. 1117.

Total added Percentage Discharges not Re-convicted as of December 31, 1959

Year of discharge	*Borstal*	*Young Prisoners*
1954	42·7%	40·5%
1955	43·7%	46·0%

One set of discharges appear to favour the Borstal system, the other the prison system. However, it is similarity between results that is most interesting. A reformed system does not appear to be doing any better in changing offenders into non-offenders than an unreformed system. In part, this might be explained by suggesting that the unreformed received a type of inmate more likely to succeed than the typical Borstal reception. A piece of research by Sir George

Benson (1959) is against this suggestion. Using the prediction tables developed by Mannheim and Wilkins (1956) (which make use of pre-institutional data to predict post-institutional performance) Benson was able to demonstrate that, for similar prediction groups, Borstal and Y.P. have similar success rates.

Percentage to Success related to Mannheim-Wilkins Prediction Category

	Borstal	*Y.P.*
AB	75	74
CD	30	34

One further point also should dishearten reformers, the Borstal success rate is declining (60 per cent. of discharges in the late 1930s did not reappear in court, compared with 40 per cent. of today's discharges), not only generally but also amongst the receptions who, using the Mannheim-Wilkins prediction score, should be good discharge risks.

Percentage Success of Borstal Discharges Three Years after Discharge

	1948	1950–1951	1952–1953	1954–1955
AB	75	58	56	63
CD	29	32	27	27

Therefore on the three counts it is argued that reforms advocated by reformers cannot be pressed with the confidence they sometimes appear to merit: first, the success of the reformed penal system is no better than that of the relatively unreformed system; second, the success of the reformed system on a similar type of inmate is no better than that of the unreformed system; third, the overall success of the reformed system is declining as are the success rates with particular " types " of reception.

In reply it could be argued that the example of an " unreformed " system, the English Young Persons' prison system, is not a good one; that, compared with other penal systems, it *is* advanced and reformed; for example, it does already have a compulsory after-care system. This is in part true, but industrial and educational training in Borstals is far in advance of Young Persons' prisons and a recent Advisory Committee report (Home Office, 1960 b) recommends the incorporation of the Young Persons' prison system into the Borstal system, *i.e.*, to make present Y.P. prisons like Borstals. Therefore it appears that penal administrators believe that the Borstal system is " more reformed " than the Young Persons' prison system. If this is so and if this reform is likely to have an impact on inmate behaviour when they leave the institution, differences should already be appearing between the success rate of discharged offenders from the Borstal system and from the Y.P. system. The analysis would suggest that no difference can be discovered.

Does this mean reforms cannot be advocated? No: they can be advocated on two grounds: first, humanitarian, *i.e.*, that people should not be detained in a wealthy society under the conditions prevailing in existing penal institutions, in particular in the prisons. Reforms would simply make the present institutions better places in which to spend some time. Second, it can be argued that without introducing these reforms, the introduction of reforms most likely to change inmates would be impossible. Reforms outlined above become, in this argument, a pre-condition to introducing effective reforms into the penal system. What these effective reforms are no one has outlined. However, I doubt if penologists can advocate reforms discussed in this paper in the expectation that they will improve the success rate of existing institutions. There is no available evidence to suggest that the programmes of reform advocated by government bodies and by penologists will have any impact whatsoever on the overall reconviction rates of offenders in existing institutional systems.

*H. J. KLARE * comments:*

Dr. Alan Little argues that the reforms of the prison system suggested by some of us (D. L. Howard, Howard Jones and myself) have, with one reservation (psychological staffing and treatment) already been carried out.

I would like to suggest that this is not altogether true as far as the suggestions for reform in *Anatomy of Prison* are concerned. My proposal was a controlled experiment based on an entirely different system of classification. Instead of creaming off the good risks and putting them into open and training prisons (which allows us to win victories that are perhaps too easy) and keeping the majority of bad risks in local and central prisons (which sets us a task that may be too difficult), I suggested a broad division into four risk categories, A, B, C and D. Only one of these categories (the grossly psychopathic D group) would be sent to separate institutions. The other three categories would be treated together. Open institutions would not be used for the best risks but as terminal treatment for all three. The hypothesis was that, with intensive group therapy (*not* group counselling) in small groups in a small institution (small enough to allow sufficient group discussion amongst the staff to cope with their anxieties) the presence of the good-risk As and Bs would allow sufficient pressure to be generated on the Cs so as to obtain significantly better results in the A, B and C categories together than would be obtained if the same treatment methods were used with the present methods of classification (which seems broadly to separate the As and Bs from the Cs and Ds).

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* Secretary of The Howard League for Penal Reform; author of *Anatomy of Prison.*

The controlled experiment was never carried out; and neither the proposed classification nor the treatment method resemble what goes on in Borstal today.

ALAN LITTLE replies:

Mr. Klare says I have not done justice to his ideas in three ways: first, the idea of a controlled experiment in penal reform; second, the idea of group therapy; and, third, the idea of an institution with inmates who are adverse personality types. With the first point I am entirely in agreement; I believe that one way of developing an adequate penal theory is to experiment under controlled conditions, in existing penal institutions. In fact, I have argued the case for such a policy as a solution to our present ignorance about penology. (See *Twentieth Century*, Winter 1962.)

As far as group therapy is concerned, I agree that it is not the same as group counselling, but, as Mr. Klare himself says (footnote, p. 125, *Anatomy of Prison*, Penguin edition) the development of the latter is to "be most warmly welcomed as an important step forward." My argument is that the two techniques are similar, and if one does not work it ought at least to make us uncertain about the other. Group counselling is an approximation towards Mr. Klare's ideas, and therefore can be used as a partial test of these ideas.

On the method of allocation I have little to add. Mr. Klare's categories are so broad that it is not possible to know the extent to which existing Borstal classification is inconsistent with his argument. Further, I would argue, if the reforms he suggest do not work for the "better" personality types (where, according to Mr. Klare, successes are too easily won), I see no reason why they should work in an institution with a mixed population. My case was not only that the overall success rate of a "reformed" penal system was declining, but also that its success rate with allocations that had a good prognosis (in Mannheim-Wilkins terms) was also declining.

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THE TREATMENT OF CHARACTER DISORDERS*

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PSYCHOANALYSIS and allied group treatment methods are accepted as the treatment of choice in the neuroses. Training in psychoanalysis is available to any suitable candidate who can afford to pay for it, and more and more analysts are turning their attention to the problems of general psychiatry, short-term methods of treatment, the special problems of institutional treatment and so on. However, there is as yet no certainty regarding the most appropriate treatment for certain types of character disorders of the sociopathic or inadequate types. The lack of capacity to form social relationships, relative inability to empathise, and unwillingness to accept the fact that they need help makes it difficult to hold them in out-patient, psychoanalytically oriented psychotherapy. For some of these cases at least it would seem that in-patient treatment specially designed to meet their needs offers a more promising approach.

In Britain the Mental Health Act, 1959,[1] enacts legislation which makes possible greatly extended treatment facilities for this type of patient and places the responsibility for their treatment on the medical profession. Perhaps unfortunately, they have chosen to use the term " psychopath " which they define in the widest possible terms as " . . . as a persistent disorder of personality . . . which results in abnormally aggressive or seriously irresponsible conduct on the part of the patient, and requires or is susceptible to medical treatment." The Act provides for the treatment of persons with character disorders (or psychopaths) whether they have broken the law or not and legislates for the transfer to treatment centres of suitable cases from the courts and from prison. Treatment may be arranged in mental hospitals, state criminal mental institutions, prisons, in special units for the treatment of psychopaths, or by probation procedures. It still remains to be seen how successfully this legislation will be implemented. In Britain as in the U.S.A. there is a strong resistance on the part of psychiatrists to this type of patient. This attitude stems from the supposed untreatability of many of these cases.

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[1] London: H.M.S.O. 1959.

The great difficulty seems to be that the psychopath calls for treatment techniques which differ from those which apply to the neuroses. Moreover, relatively little attention has been given to this topic compared with the treatment of the neuroses, and all too frequently the problem is by-passed by rationalisations which say, in effect, why bother because these people are untreatable anyway. In this connection, it would be interesting to know how many professors of psychiatry in the U.S.A. or Britain at the present time give their students any encouragement to think of this type of case as amenable to treatment. Indeed, one is tempted to go further and raise the whole question of our cultural attitudes towards this theme.

The first point I wish to stress is the psychopath's symptomatology. These symptoms belong to the so-called alloplastic group (see Eissler, 1955) where the impulse is " acted out " and results in a change in the external reality situation. In the autoplastic disorders the impulse is opposed by the individual and the conflict or tension dealt with within the pysche with resulting symptom production as, for instance, in conversion hysteria. It is the alloplastic nature of the symptoms which makes them so difficult to recognise as aspects of an illness. Stealing, lying, embezzling, etc., evoke quite different responses in people compared with the autoplastic symptoms (*e.g*:, headache and other conversion symptoms). Moreover, the symptoms of the alloplastic disorders cause little or no displeasure or anxiety. More important, however, is the fact that the psychopath appears to show relatively little concern regarding the effect of his behaviour on other people and seems to have comparatively little awareness of social values. This would appear to be related to the psychopath's inability to empathise. (Parker, 1957.) Piaget (1932) has shown that this process of social learning is characteristically found in children's games and behaviour around the ages eight to ten. In the psychopath, however, group values have never become an integral part of his personality, and this defect is given none of the interest or understanding shown to other forms of mental defect which are unquestionably recognised as "illness." Along with this anomaly of growth is found the essentially "selfish" characteristics of the psychopath where the achievement of instinctual gratifications without delay and the apparent absence of conscience loom large.

Society may be loth to label the psychopath as ill, but certainly the psychopath himself is even less willing to consider himself in this light. This is not surprising when one considers the inability to form object relationships which characterises this condition. He feels isolated and unwanted but sees *others* as misguided and hostile rather than himself. There is considerable evidence to support the view expounded by Bowlby (1951) and others (Gesell and Amatruda, 1947; Spitz and Wolf, 1946) that these unfortunate people lack the stable parent figures which are essential for the early development of object relationships and for the incorporation of such figures in the development of a relatively benign conscience. All this contributes to the initial difficulty in treating the psychopath. How can one help him unless he himself wants help? Even if the fear of punishment drives him to seek help how can one help him to form a relationship with the therapist when he cannot relate for any length of time with anyone? How can he talk about intimate things with the therapist when part of his problem is his inability to communicate subjective matter? How can he accept help from a doctor who is clearly associated with authority, and this is particularly true of prison doctors or cases referred for treatment from the courts?

It is because of the above considerations that most of us who have to undertake the in-patient treatment of these people prefer to do so in an environment which has many of the characteristics of a therapeutic community.[2] In such a setting the aim is to offer the new patient a peer group where authority is minimised and the opportunities to form relationships maximised. The more the patient can come to identify himself with the treatment unit the more will he be prepared to examine his own behaviour and compare his own norms of behaviour with those of the group. Moreover, many of these patients have never felt that they " belonged " anywhere and everything should be done to achieve this feeling. By elevating the status of patients and giving them the greatest possible number of role-playing opportunities, including active participation with the staff in group treatment and other responsible activities, we can do something to overcome the feeling that the staff are privileged, distant people who speak another language and are identified with authority rather than with the patients. Above all, we have got to find ways and means to overcome the individual's inability to form relationships. All staff and patient roles are important in this respect and we feel that *any* relationship can help provided the danger of defences such as " pairing off " or other special and often neurotically determined relationships can be avoided. We believe that treatment can be aided by a generally accepted " feed back " system, so that communicated material comes back to the group with trained staff present. We go even further and feel that the therapeutic culture is enhanced if the majority of staff and patients come to feel that no communications should be automatically regarded as privileged and any relevant material made available to the group if it is thought to be in the patient's own interest.

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[2] See Jones (1959). There are several units for the treatment of character disorders and other types of patients which have the characteristics of a therapeutic community. Examples include Atascadero State Hospital and various projects in the Department of Corrections in Californa; in Europe, Dr. Landers and his colleagues at Wormwood Scrubs Prison in London, Professor Baan and his colleagues at the Van der Hoven Clinic in Utrecht, Dr. Stürup at Herstedvester near Copenhagen, and the Social Rehabilitation Unit at Belmont Hospital near London, now renamed Henderson Hospital.

We are considering patients who are, in the main, unwilling to participate in treatment. The social climate in an established therapeutic community helps to overcome this resistance. " The therapeutic community is distinctive among other comparable treatment centres in the way the institution's total resources, both staff and patients, are self-consciously pooled in furthering treatment. This distinctive way implies above all a change in the usual status of patients. In collaboration with the staff, they now become active participants in the therapy of other patients and in other aspects of the overall hospital work tasks—in contrast to their relatively passive, recipient role in conventional treatment régimes." (Jones, 1959.) The establishment of an appropriate therapeutic milieu alone will not overcome the communication difficulties and emotional estrangement of the individual who has never been able to form social relationships. It seems fairly certain that these " affectionless characters " need skilled psychotherapy, but whether this should be on an individual or group basis or both is still an open question. Our own preference is a combination of community [3] and group methods, with a minimum amount of individual contact between doctor and patient. The doctor or treater [4] lends his skills to the understanding of the current scene. The therapeutic culture exerts pressures to talk about feelings and examine behaviour not only in the formal group treatment setting but in informal situations too. It also approves the examination of the motives behind behaviour, particularly deviant behaviour, and the implication that any patient can give as well as receive treatment. All these pressures contribute opportunities for the treater to exercise his skill. He does so not only in the daily group of his own patients but also in the community meetings with the other doctors and core staff present. This procedure means that day after day the whole community examines the deviant behaviour of some of its members and the implication is that such behaviour should and can be modified. Such a belief clearly helps therapy but cannot be maintained unless patients are aware of the improvement in their social relationships not only in the relatively artificial atmosphere of the institution but also in their relationships with people in outside life. Family groups within the institution can help this process, as can frequent home visits at the rehabilitation stage of the treatment.

To be able to communicate with patients with severe character disorders the doctor or therapist needs to be able to relate to them at a feeling level. These patients are frequently not able to express abstract ideas or conceptualise, and for this reason as well as their difficulty in forming a positive transference they cannot easily benefit from individual therapy. They act out their feelings on their environment and this form of immature communication must be understood and used in the therapy. Also, the therapist in a therapeutic community is a real person with personality characteristics which are well known to the patients. In these circumstances it is difficult for a patient to maintain a transference image for long, and indeed it becomes extremely difficult to know what *is* transference in these circumstances. The fact is that, even more than in small therapeutic groups, transference tends to become diluted in various people in the total community. Nevertheless, the recognition and handling of transference and counter-transference does have an important place in treatment, particularly in the later stages. Another factor determining the doctor's treatment role is his association with real life situations, in which he is quite unlike the psychoanalyst. We cannot play an objective, neutral, purely therapeutic role but have to take on realistic and restrictive roles at times. We cannot, as in the case of the psychoanalyst, leave this to be dealt with by the police and outside society. As delinquents, particularly those with a low social maturity rating (see Grant, 1959), tend to respect individuals who can manipulate their environment to suit their own ends, the treater has to be ready to " outsmart " the patient and unhesitatingly call his bluff, expose his deceit, etc. This kind of relationship is essential early in treatment but is not limited to the doctor-patient relationship. Few doctors have sufficient familiarity with the domestic or cultural milieu of the patient to be able to play this role with any marked degree of success. Luckily, in a therapeutic community this role relationship is frequently met by one of the patient's own peer group.

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[3] By community we mean the involvement of all patients and staff in treatment in both the formal and informal sense.

[4] There seems no reason why a psychiatrist should be the therapist. The important considerations are training and personality and not the possession of a medical degree.

Once the patient has begun to identify with the community, treatment becomes more circumscribed. He now begins to internalise many of the values held by the group and begins to be aware of the effect of his behaviour on other people. (This represents a transition from alloplastic to autoplastic behaviour.) This phase is familiar to the patient population themselves who often refer to it as " so and so is coming into treatment " or more indirectly as " one has to get worse before getting better." At this point treatment takes on a much more familiar picture. The treatment challenge represented by the type of patient we have been discussing is to get him to the point when he can form social relationships and identify with a group. From the administrative therapeutic point of view this is the point at which controls from without should increasingly give way to controls from within.

In brief, the therapeutic community as I have attempted to describe it in very general terms affords, at the early stages of treatment, a milieu where the new patient, isolated and unable to form relationships, suspicious and fearful of authority, can relate to his peers sufficiently to test out possible ways of altering his behaviour and attitudes. The skill of the therapist lies in his ability to communicate and feel for the patient and achieve status in his eyes by being smarter than he is. Having achieved this he then has to help the patient to see what there is for him in social change. At a later stage in treatment the therapeutic community affords the patient increasing role-playing opportunities and puts pressure on him to supply his own controls from within.

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CURRENT SURVEY

RESEARCH AND METHODOLOGY

CURRENT RESEARCH LXXXIII

(*Continued from Vol. 3, p. 162*)

MIDDLE-CLASS OFFENDERS

(1) *Name of University Dept., Hospital or other Institution or private person supplying the information.*

The New Bridge; and Sociology Department, London School of Economics.

(2) *Subject of Research.*

A study of the prospects facing the middle-class offender (generally referred to as "the white-collar criminal") upon and after his discharge from prison, with particular reference to problems of employment and the social and occupational mobility of these men.

Method: (a) A follow-up study of 94 middle-class offenders one month, four months and eight months after discharge.

(b) An inquiry into the attitudes of professional bodies and associations towards ex-prisoners of the white-collar variety, and towards members guilty of unprofessional conduct.

(3) *Under whose auspices is the research being carried out?*

The New Bridge. Financed by the Isaac Wolfson Foundation.
Research worker: G. E. Levens; *Supervisor*: Dr. T. P. Morris.

(4) *Commenced*: July 1961. *Completion expected*: July 1963.

(5) No publication so far.

RECIDIVISM

PIET J. VAN DER WALT [*]

IN THIS note we wish to draw attention to a very important and illuminating empirical investigation recently conducted in Holland into two groups of recidivists, the report of which is available only in Dutch. This investigation has produced interesting and valuable findings and has also most pertinently drawn attention to the problems and drawbacks associated with such an inter-disciplinary research project. In addition, it has given direction to research, for which there is a great need.

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Prof. H. van Rooy, who was in charge of this investigation, is a leading criminologist in Holland who has already distinguished himself in the field of research. He recently visited South Africa to investigate prison systems in force in this country, and has also travelled extensively on study grants in America, Canada, England and a number of European countries. He has a particularly good knowledge of the literature and problems of criminology. In 1954 the then Minister of Justice in Holland requested Prof. van Rooy, Professor of Criminology in the Rijks University in Groningen and Director of its Institute of Criminology, to undertake an investigation into recidivists serving prison sentences (REC's) as well as other recidivists detained at the Government's pleasure (TBR's). Prof. van Rooy was assisted by a number of experts in allied subjects, including a sociologist, a psychiatrist and a psychologist; and in 1956 the findings of this interesting and enlightening inter-disciplinary investigation were published in a *Report on the Work and Findings of the Criminological Investigation into Recidivists and Indeterminate Prisoners at Groningen Prison over the period 1954–55*. Only a limited number of duplicated copies of this report are available. To give wider publicity to these findings a summarised version was issued in 1957 by the Study and Information Centre of the Ministry of Justice under the title: *Criminological Investigation into Recidivists and Indeterminate Prisoners.*

The purpose of the investigation was to make a comparative study of two categories of recidivists in Groningen Prison. The first category consisted of duly convicted professional and habitual criminals who were serving a definite term of imprisonment in this prison (REC's). The other category were also convicted recidivists, but their detention at the Government's pleasure had been ordered because of evidence of defective or pathological derangement of mental faculties (this group is known in Holland as TBR's). In juridical literature they are referred to as being less criminally responsible and are known as psychopaths. These TBR's are housed and cared for in a separate wing of the prison, called an Auxiliary Asylum.

It was necessary to investigate whether the difference in the penalties imposed for the two groups was justified and whether there was a genuine difference in their nature, essence and circumstances. Were there in actual fact such differences in personality composition as would account for, or at any rate make understandable, the application of the TBR measures to one group of recidivists and not to the other? Or were there sufficient points of resemblance between the two groups to enable the existing differentiation in penitentiary treatment to be ascribed to fortuitous and more or less arbitrary factors?

To carry out this investigation, the recidivists were divided into two groups. The first consisted of sixteen recidivists who have never received an indeterminate sentence, and the other of sixteen who, on one or more occasions during their criminal careers, had been sentenced to indeterminate detention, either conditional or unconditional. Four lines of approach were adopted from the standpoints of criminology, sociology, psychiatry and psychology. Each collaborator produced a resumé of the work done on a particular aspect, and these served as the basis for the final comprehensive report compiled by Prof. van Rooy.

The contents of the report fall into the following four sections:

1. *The criminological sector*

The criminological data collected about the recidivists covered:

(a) their criminal behaviour;
(b) their convictions;
(c) their prison sentences; and
(d) their reactions following on the probation programme.

This information was obtained mainly from official sources including personal files (32), penal records (508), probation reports (148).

Between them these thirty-two recidivists could muster 547 crimes and 378 sentences. The findings were that, in spite of some similarities, distinctive group differences could be traced between the two categories of recidivists on approximately sixteen points of comparison. The main findings may be summarised as follows:

(i) The TBR's committed fewer "invoelbare" crimes. By the "invoelbaarheid" of a crime is meant the extent to which it is influenced by the external living conditions in which the recidivist finds himself. In establishing the "invoelbaarheid" of economic crimes, it was required that the subjects of the investigation
    (a) should have little or no income;
    (b) should not, in the case of juveniles, have been in receipt of reasonable provision from their parents;
    (c) should have appropriated to themselves some article of value;
    (d) should not, in so doing, have harmed someone intimately related to them, such as a parent, fiancée or benefactor;
    (e) should have subsistence as their motive.
(ii) The TBR's committed fewer crimes on the street or in public places.
(iii) They were guilty of few offences in places where they were known or at the expense of friends and acquaintances.
(iv) For the TBR's spring was the season in which economic crimes showed an increase, whereas the peak period for the other group was winter. The REC's presented a more normal pattern of distribution of their crimes over the various seasons.

(v) It became evident that the lapse of time between their release from prison and their next offence was on the average shorter for TBR's than for REC's.

(vi) The average number of crimes involved per conviction was somewhat lower for TBR's.

(vii) The prison sentences imposed on TBR's were shorter—even in periods when the possibility of an indeterminate sentence had not yet entered the picture.

(viii) Practically no difference was found in the types of crime committed by the two groups.

(ix) More favourable probation reports were made on the TBR's.

(x) More chances on probation were given to the TBR's.

(xi) The percentage of failures was lower among the TBR's than among the REC's.

2. *The psychological sector*

The psychological investigation covered an extensive field and use was made of intelligence, projection and other tests. A study of similarities and dissimilarities in the intellect and character of members of the two groups produced the following results:

(i) In the various tests, the reactions of the TBR's deviated more widely from the norm of the population than did those of the REC's.

(ii) The Rosenzweig Test disclosed that the TBR's are more " intra-punitive " by disposition, *i.e.*, they show a stronger tendency towards self-reproach and a greater sense of guilt and shame, which result in a tendency to blame themselves for the frustrating situation.
The REC's, on the other hand, revealed more of an " extra-punitive " disposition. They are more inclined to blame society or their associates for their difficulties.

(iii) According to the Zondi Test the TBR's suffer more keenly from their conflicts and guilt feelings than the REC's, who project their conflicts onto the outside world.

(iv) On the average, the TBR's are of lower intelligence.

(v) The REC's show greater skill in solving concrete and practical problems.

(vi) The Rorschach Test disclosed that the TBR's are more easily thrown into confusion by emotional stimuli than the REC's.

(vii) The TBR's have a more ambivalent response to impulses and a defective regulation of their natural passions.
With this background in mind, it is not surprising that the crimes of the TBR's seem to be further removed from the normal than those of the other group.

3. *The psychiatric sector*

In the psychiatric investigation attention was given, *inter alia*, to hereditary factors, details from childhood and adolescence, married life, physical constitution and mental deviations. The main findings were based on medical and neurological-psychiatric examinations.

Medical-psychiatric aspects. The TBR's suffered to a greater extent from physical weaknesses, *i.e.*, their physical constitution was less satisfactory. They were more prone than the other group to stomach ailments, disturbances of the liver, tuberculosis of the lungs, pleurisy and kidney trouble.

Neurological-psychiatric aspects. The TBR's were more "deficient" than the REC's.

The compiler of the report stresses that these findings must be taken only as indications. Owing to the highly individual nature of the investigation definite evidence could not be obtained, and it was difficult to establish any group behaviour.

4. *The sociological sector*

To gain an insight into the social background of the recidivists, investigations had to be carried out into their family history, environmental conditions, childhood and schooldays, their attempts at adjustment to society (*via* family and working life), and their reactions to contemporary circumstances such as war and crises.

The original report devoted considerable attention to the sociological aspect, but in the 1957 publication it was almost entirely ignored. The reason lies in the fact that the differences revealed in the criminal conduct of the two groups did not provide sufficient grounds for a comparative study. Evidently the results did not lend themselves to a satisfactory scientific interpretation of the group attitudes.

To sum up, it may be said that the investigation demonstrated clearly the existence of distinctive group differences between the two categories. These are not based on merely fortuitous factors, but must be ascribed to the greater deviations and somewhat more severe disturbances which characterise the TBR's. Prof. van Rooy puts forward this general conclusion with caution, in view of the striking similarities found alongside the differences. What has, however, been clearly established, is the fluidity of the dividing-line between the two groups—which may be attributed to the fact that among the individual members of the groups variations are to be found in the degree of disturbance, ranging from little or none to severe.

A further important finding was that the composition of the two categories was by no means accurate, in that some individuals classed as TBR's should rather have been classed with the REC's, and vice versa. The inclusion of these individuals in one group or the other may be said to have been a matter of chance, *i.e.*, the legal decisions in these borderline and doubtful cases were not always correct. I would say that this important finding in itself justifies the investigation and gives good grounds for a further investigation.

Prof. van Rooy quite correctly points out that the results are in the first place valid for the thirty-two recidivists who formed the subject of the investigation, but that this group is not entirely unrelated to other recidivists whom the investigators came across in the same prison and auxiliary asylum. He goes on to discuss the claim of the test-check group to be representative and arrives at the following conclusion:

The general outcome of the investigation into the representative character of the REC's and TBR's who were investigated may therefore cautiously be formulated in this way and there is little reason to expect that the results so far established—at least as regards the *main points*—would not retain their validity in any extension of the investigation to a larger number of prisoners. It can, for example, be considered highly improbable that the very existence of distinguishing differences and their general character, the greater degree of deviation in the TBR group, are results which would not be repeated, should the investigation be continued amongst the remaining REC's and TBR's. Likewise it may be stated with a fair measure of certainty that the inaccuracy established in the composition of the groups is not a finding which would be limited to the offenders concerned in this investigation.

From this it follows that the findings of this investigation do not apply exclusively to these two groups of REC's and TBR's. Deductions can undoubtedly be made from them about the relations existing between the remaining members of both categories who were not investigated. Some value may therefore also be attached in this sense to the investigation, regarded as a "random sample" (pp. XLI–XLII).

In conclusion I might point out that so intensive a study of a group of recidivists, from so many different standpoints, is significant and of great value. The investigation was planned and carried out in a scientific and expert manner, under the inspiring leadership of Prof. van Rooy. This ensured the scientific foundation of the conclusions drawn, which makes this survey an acquisition to the literature of criminology and a milestone for further research and discussion.

A COMPARISON OF WECHSLER, REVISED BETA AND OTIS SCORES OF DELINQUENT BOYS

David C. Twain and Edward M. Brooks

Problem

This investigation attempts to determine the efficacy of group testing methods in obtaining an adequate estimate of the intelligence of institutionalised delinquent boys. The National Training School at Washington, D.C., is a

Federal Institution for male juvenile delinquents under the administration of the Bureau of Prisons. The general age range of the boys is fourteen to eighteen years; the population averages 400, with new arrivals at the rate of ten per week.

Method

The population for this study consists of approximately 50 per cent. of new arrivals to the National Training School over an eight-month period. The criterion for intelligence was the individual administration of the Wechsler Adult Intelligence Scale (WAIS) or the Wechsler Intelligence Scale for Children (WISC). The group intelligence tests were the Revised Beta Examination (Beta) and the Otis Intelligence Examination, Intermediate Form. The boys were examined over a period of several months in groups of approximately ten with the total battery of group tests. They were later, within a period of several weeks of initial examination, administered the individual intelligence test.

For purposes of analysis, the total sampling population was divided into four groups:

> Group I consisted of ninety-seven boys exhibiting reading problems and/or motivational problems in relation to the testing material. Also included were boys showing a large discrepancy between Otis and Beta scores.
>
> Group II consisted of fifty-three boys presenting no unusual problems in the group testing situation.
>
> Group III is composed of the 150 boys in Groups I and II.
>
> Group IV, eighty-two boys in Group III whose Otis and Beta scores differed by ten or more points.

Correlations were computed for all four groups between the following scores: Otis and Wechsler Verbal (WV), Otis and Welchsler Performance (WP), Otis and Wechsler Full Scale (WFS), Beta and WV, Beta and WP, Beta and WFS, and in Group II, the averaged Otis and Beta scores and WFS.

As shown in Table 1, Group I scores differ rather markedly from those of Group II. While the mean scores for all tests in Group II approximate the norm of 100, the mean scores for Group I are invariably below this level, with the highest mean score occurring on the Beta examination. Table 2 describes the Beta Examination to be, in all circumstances, the best predictor of the Wechsler scores for Group I, while the Otis is the best predictor of the WV and WFS scores for Group II. The Otis correlates most highly with the WFS for Group II and the Beta for Group I. Otis and Beta scores tend to be similar in those cases where the intellectual level is more nearly normal (Group II), and show disparity in those cases where measurement of intelligence is influenced by non-intellectual factors (Group I). It will further be noted, in this regard, that Group IV also manifests a higher mean score on the Beta than on the Otis.

Results and Discussion

Table 1

Mean Test Scores

	I	II	III	IV
Otis	73·25	97·32	84·69	76·72
Beta	92·08	102·38	95·71	97·28
WV	84·41	101·60	90·57	89·06
WP	89·19	98·09	92·38	91·35
WFS	85·67	100·24	90·83	89·32

Table 2

Correlations

	I	II	III	IV
Otis-Beta	·52	·73	·64	
Otis-WV	·53	·76	·74	·66
Otis-WP	·48	·75	·61	·52
Otis-WFS	·55	·81	·75	·68
Beta-WV	·54	·61	·63	·51
Beta-WP	·77	·80	·80	·76
Beta-WFS	·71	·77	·76	·71
Averaged Otis-Beta-WFS		·86		

Table 2 presents an averaging of the Otis and Beta scores in Group II and the correlation of this average with the WFS scores. This composite produces the highest correlation obtained from group testing to WFS scores when the group tested is approximately normal.

The results of this study indicate that the experienced clinical psychologist can utilise the group administered Otis and Beta in combination or separately to achieve an adequate measure of intelligence under varying conditions.

THE RELATIVE FREQUENCY OF THE SEXUAL PARAPHILIAS AS DEMONSTRATED BY 159 GRAFFITO

J. Housden

Various estimates have been made of the incidence of homosexuality. Havelock Ellis (1928) quoted a figure of 2 per cent. of the adult population. Most of the recent estimates draw on the work of Kinsey and his co-workers

(1948), and West (1955) says that if we assume that one in twenty of the male population is homosexual, we shall not be far wrong. When we turn to sexual deviations other than homosexuality there is an almost total lack of information as to their incidence.

Curran (1954) found that, in a series of 4,000 patients seen in private practice, sexual deviation was the primary problem in 100 cases. In his 100 deviates there were seven exhibitionists, five fetishists, five tranvestites, twelve sado-masochists, and seventy-one homosexuals. From these figures it would appear that the various paraphilias are relatively rare in comparison with homosexuality. However, it may well be that paraphiliacs do not seek treatment as frequently as do homosexuals.

In a group of prisoners investigated for psychiatric treatment East and Hubert (1939) found the following distribution of sexual deviations:

Homosexuality	79	Fetishism	5
Exhibitionism	35	Bestiality	4
Sadism	17	Pornography	2
Masochism	8	Pygmalianism	1
Arson (sexual)	1		
Necrophilia	1	Total	155
Transvestism	2		

This was a select group, however, and does not accurately represent the whole class of persons convicted for sexual offences, let alone unconvicted sexual deviates. It is also pointed out by the authors that the perversions overlap in individual cases, and that 30 per cent. of this group showed a secondary perversion. This was also apparent in the information collected by the present author.

Hamburger *et al.* (1953) report that they received a large number of letters after the publicity that accrued to the Christine Jorgensen case, and that these letters make it clear that transvestism is a widespread deviation. That fetishism is of frequent occurrence can be surmised from the number of reports in certain sections of the Sunday Press of cases of " pantie stealing."

Kinsey and his associates (1953) thought that the inscriptions to be found on lavatory walls might furnish useful information about the secret desires and wishes of the inscribers. Unfortunately, the information they quote (p. 674) is not sufficiently detailed to give us any idea of the frequency of festishistic, sado-masochistic, or other paraphiliac fantasies. The present author has been noting all the graffito relating to sexual activity that he has observed during the last two years. It would appear that, whereas in some cases these writings represent fantasies (wish-fulfilments), in many instances there is no reason to doubt that they are true statements of fact. In any case they do, when analysed, give us some idea of the relative frequencies with which various deviate activities loom large in the psycho-sexuality of the male population.

The material at present to hand consists of 159 verbatim transcriptions. They have been collected from 23 different public lavatories, for the most part in the Greater London area. All the legible inscriptions that have been seen over the course of two years have been recorded. The following table shows the number of inscriptions that refer to particular perversions:

Transvestism	46	Fellatio	4
Fetishism	37	Lesbianism	2
Homosexuality	22	Frotteurism	2
Masochism	16	Troilism	1
Sadism	9	Oralism	1
Cunnilingus	8	Incest	1
Analism	5		
Paedophilia	5	Total	159

It was found in many instances that the same inscription referred to more than one perversion. Masochism and transvestism were a frequent combination, and so were homosexuality and sadism/masochism. Masochism also featured in many inscriptions that were primarily fetishistic in content, and it was sometimes difficult to differentiate between homosexuality and transvestism. In all cases where more than one paraphilia was referred to, the inscription has been classified under the perversion that seemed to be the dominant one.

The four references to fellatio are all heterosexual in content, although the twenty-two homosexual inscriptions also contained many references to fellatio. In the paedophiliac entries it was always young schoolgirls that were the desired sexual object, and in at least two of these cases an element of knickers fetishism could be detected. Analism, in the table, refers to anal intercourse with a female partner. The two inscriptions dealing with lesbian themes referred to the fact that their author enjoyed watching such activities. The majority of the fetishisms were for knickers, closely followed in frequency by rubber mackintoshes.

Although no firm conclusions can be made from this material, there is an indication, from the relative frequencies of the various themes, that transvestism and fetishism are at least as prevalent as homosexuality.

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NOTES

CHILD GUIDANCE PROCEDURE IN RELATION TO THE JUVENILE COURT

JACK H. KAHN and JEAN P. NURSTEN

SUMMARY:

This paper is a study of the procedure and aims of examination of the children sent by the Juvenile Court for psychiatric reports. The purpose and use of the reports are discussed and the reasons for the referral of the children are given. The study has been based on a retrospective analysis of the first twenty-five cases referred to a new Child Guidance Clinic.

The Background of the Clinic and the Cases

The appointment of the staff to the Child Guidance Clinic was made in December 1957 and clinical work began in January 1958. It is a joint-user clinic with the psychologist and psychiatric social worker provided by the West Riding County Council Health Department and the psychiatrist by the Leeds Regional Hospital Board. At first this team visited the clinic together on only one day each week, which gave a staff ratio very different from the one suggested in the Underwood Report,[1] but in October 1958 it was arranged that the psychologist and the psychiatric social worker should attend on an additional day. The clinic premises are provided by the local authority and the clinic serves three health divisions. The town in which the clinic lies is a convenient centre for the area; it contains a large proportion of the population and provides a relatively greater amount of the clinical referrals. Within the area there are four petty sessional divisions, but it is the local juvenile court which has provided by far the largest number of referrals for psychiatric reports, and the Bench began to make use of the clinic immediately. Good relations were readily established and this paper is an attempt to examine the procedure which has been built up, and to speculate on our own aims. With less foundation we also offer speculations on the possible reasons that actuate the court to make referrals.

The report to the court is made up from the observations of the psychiatrist, the psychologist and the psychiatric social worker and often contains quotations from the records of the interviews which the last two have held. It is, nevertheless, signed by the psychiatrist alone. The amount of time involved in the examination and the preparation of the report adds up to about five hours.

In the analysis of the first twenty-five cases referred to the clinic it has been found that seventeen were sent along in 1958 and eight in the first nine months of 1959 and we have estimated that this represents a quarter of the total number of juveniles appearing before the court. In relation to the total number of cases referred to the clinic and receiving full service, the number in 1958 referred by the court was one-third of cases seen. This seems a large proportion of the clinical work and it is questionable whether this ratio would be desirable if a large number of cases had been built up on the waiting list. The cases were found to be in the following sex and age groups:

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[1] Report of the Committee on Maladjusted Children (1955). London: H.M.S.O.

Boys	8–13 years	14		
	14–17 years	5	Total boys	19
Girls	8–13 years	2		
	14–17 years	4	Total girls	6

A picture of each child's personal background was arrived at by taking five sociological factors which could make for a difficult history. These factors were suggested by Grünhut (1957) in his book *Juvenile Offenders* and it was thought useful to keep to these categories in case more detailed comparison were made later. The five headings were (most children had more than one factor):

Broken home	14
Disharmony in home	9
Lack of standards	12
Crime in family	3
Personal maladjustment	12

The reasons for the appearance in court were, in each case, listed under the four headings under which it is possible for a child to be brought before the court, as follows:

For an offence against the law (aged 8 and below 17)	18
As in need of care and protection (any age below 17)	1
As beyond control of parent or guardian (any age below 17)	1
For failing to attend school (aged 5 and below 15, or 16 if at special school)	5

The overt reasons for the court's request for a report came under the headings suggested to the Underwood Committee by the London Society of Probation Officers as being the reasons why the London Juvenile Bench asked for reports. The reasons were:

The irrationality of the child's conduct.

In recidivism, a desire to establish whether or not the child is capable of being influenced by ordinary methods or whether the cause of his delinquency lies deeper.

The known existence of traits in addition to the delinqency itself, such as bedwetting, that may indicate maladjustment.

The sexual nature of the offence, when it is felt important to gain knowledge of the child's state of mind.
When removal from home is under consideration.

The highest numbers of children were sent to the clinic by the court because of recidivism and when removal from home was under consideration. However, the overt reasons are not the only ones operative and covert reasons are thought to exist, but we feel it would be presumptuous to discuss them at this stage and they may only be our own projections.

Out of the twenty-five cases sent along to the clinic, the recommendations contained in the reports written on the children were accepted in twenty-one cases (that is 84 per cent. for comparison with other studies), varied in one and ignored in three cases. This rate of acceptance appears to be one that should be attainable and aimed for, as Clouston and Lightfoot (1952) at the Maidstone and Tonbridge Clinics found 82 per cent. acceptance for junior boys and 70 per cent. for senior delinquents. In our study it was found that the acceptance rate, too, was lower amongst the reports furnished on the older children. The four instances where the reports were varied or ignored were all in the 14–17 age group. Markey and Langsam (1957), in an American study, quote a figure of 86 per cent. agreement between the suggestions within the report and the courts' action.

The methods of disposal which the court in our area adopted were:

Those which meant that no immediate further action was taken:		
	Conditional discharge	6
	Absolute discharge	0
Constructive measures:		
	Probation	8
	Fit Person Order	6
	Approved School	3
Punitive measures:		
	Fines	2

Treatment within the clinic was offered in six of the cases, which meant that nineteen cases were for a diagnostic report only, but apart from direct treatment we offered supervision from the clinic to other workers who were to remain in touch with the child. It is too early to assess the results of treatment, or the results in the cases where the court rejected the reports, but a special problem does arise when delinquent acts recur, or continue during clinical treatment. It has sometimes been necessary for the psychiatrist to give a second report on a child to the court and in these cases the pyschiatrist has to be aware of his own feelings of hostility to the patient in case he should feel let down in relation to his original report.

Underlying Aims in the Psychiatric Examination

These are being considered retrospectively for the purpose of this paper. In this we are following the common practice of first doing a thing and then studying what it is that we have done. The aims are:

To provide an understanding of the delinquent act against the background of personality—that is, in relation to the personal and family life of the individual. Explanation should not be based entirely on problems of family relationships that are universal and an attempt to understand the child should not automatically lead to the placing of blame on the parents. Peter Scott (1953) refers to the idea that the Bench sometimes feels that psychiatrists are too credulous and too ready to blame parents. He himself stresses that outright condemnation of parents is dangerous, because, if accepted by the court, it may lead to public censure of the parent in the presence of the child.

To show whether the delinquent act has a meaning and purpose in addition to the ordinarily accepted meaning and purpose. The act may provide ordinary satisfactions that make up for actual deprivations, or the act may satisfy normal urges in an abnormal manner. In addition it may exist as a pathological need for punishment, or may include a distortion of some other aim. The act may be behaviour considered abnormal in itself or abnormal because of the particular age of the individual, *e.g.*, sexual perversions. These provide satisfactions within the act, but are not presumably sought by normal individuals.

To offer recommendations within the legal system.

To be part of the climate of opinion and also one of the formative elements of change. The court report has to be within the range of acceptability and not of the type that would be rejected outright. (Grünhut (1957) draws attention to local variations in decisions reached by juvenile courts and says that magistrates are bound by the letter of the law on the question of guilt, but have wide discretion in the use of sentencing power. He adds that the use of punishment or constructive measures depends upon personal feelings, which in turn are affected by local tradition.) The psychiatrist is interested in the individual child, but he, too, is part of the community which makes and applies the rules within which the child is treated. He must, nevertheless, be prepared to offer appropriate comment on legal processes and at times express his views on the harmful or beneficial aspect of probation or custodial care. A recommendation which amounts to a plea for leniency, and which does not offer any constructive proposals to help the child to develop new attitudes, is a disservice. It resembles the attitude of the parent who is indulgent to a child's wishes, without offering standards of behaviour.

To offer treatment, in some cases for the clinical condition and not for the offence, as in cases of psychosis or mental defectiveness. In these cases the patient has no responsibility either for the offence or for the therapeutic process. In other cases to give treatment, where possible, to enable the patient to accept a new level of responsibility. Psychiatric treatment has sometimes been given the reputation of removing the responsibility for criminal acts from the patient, but, in fact, psychotherapy is the only form of treatment which aims at helping the patient to such understanding of himself that he can assume full responsibility for his own acts. Lastly, treatment can include general adaptive processes and can include specific treatment for any associated clinical condition and educational and environmental adjustment.

To help spread a general understanding of the various aspects of human motivation to other workers such as probation officers, children's officers, approved schools' staff, who have responsibility in connection with children and who have to deal with established delinquency or who may be in a position to prevent delinquency occurring. Markey and Langsam (1957) refer to the deepening of the court's understanding through psychiatry, and they state that as a result of this deeper insight the court atmosphere can itself become therapeutic. In Israel, in Tel Aviv, a stipendiary magistrate for the juvenile court has, as a relevant qualification for appointment, training in psychiatric social work.

Content of the Report

A history of the offence is given if it is thought to be necessary and this leads on to the more personal history of the child and his family relationships. An estimate of the disturbances, deficiencies and potentialities (including intelligence and personality tests) in the personality structure is added, along with an explanation of the delinquent act as an aspect of the personality at its present level. The diagnosis is given at a level for action, if not within clinical terms, and the prognosis presented cautiously, as this is often based on intuitive criteria. Lastly, an offer is made of recommendations within the legal system and within practical possibility as an individual child's report should not develop into a vehicle for propaganda. Suggestions for treatment, training or education of the personality features which are lacking or disturbed have to be made in such a way that they can be carried out under existing conditions. If treatment within the clinic is offered, it is necessary to stress the limitations and it is important not to be placed in the position of accepting the child for treatment on the understanding that he will be cured. The following are extracts from reports to the court which illustrate some of the points mentioned:

Case 1. Betty was referred for psychiatric report because of refusing to go to school. Personal and family history was given before the following extract which covers the dynamics and the recommendations—"Betty's fits or 'turns' are conversion hysteria and occur in connection with her relationship with her mother. These symptoms do not arise in the remand home and the warden informed me that at an early stage she stood in a fixed attitude while other girls were taking part in physical training, but joined in when no notice was taken. She stated in the remand home that she was unable to go out until she was told that, in that case, she would be unable to spend her pocket money, and after that she went out. Correspondence from the mother to the girl in the remand home has been mainly concerned with recriminations against the authorities who sent the girl away from home. The mother wishes the condition to be treated as a physical paralysis and her attitude would have the effect of maintaining the symptoms if Betty were in close contact with her. The mother would like the girl to be in a general hospital and for her to have the illness treated as a physical illness. I consider that this is a case where it is necessary in the girl's interests for some curb to be placed on the demands made upon her by her mother. I would therefore recommend to the court that this child be committed to the care of the local authority in order that residential placement may be arranged at a little distance from . . . I consider that treatment would be ineffective if the girl were to remain at home. I have been in touch with the children's officer at . . . and if the decision of the court permits this course, admission could be arranged for her at the Reception Centre and in that case psychiatric supervision might also be arranged through the Child Guidance Clinic there."

Case 2. Derek was the child of divorced parents who was being cared for in a voluntary children's home. He was referred because of frequent episodes of stealing and committing malicious damage. ". . . Derek has an extremely disturbed personality and some of his acts could be interpreted as intended to punish the mother for separating from the father and they could also be interpreted as a kind of identification with the reputed badness of his father. It is obvious that there could be no possibility of providing steady treatment in this clinic on the basis of his residence either with his mother or at the children's home because he would continue to 'act out' his disturbances, in the form of undesirable conduct, in the period before treatment would have a chance to become effective. Derek needs the protective framework of discipline, and I consider it is unlikely he could get this in other than an approved school. If this course is decided upon, it should still be borne in mind that his delinquencies arise out of a disturbance in his personality, and it might be possible for him to have psychiatric treatment while in an approved school. A further point that might be considered is the possibility of using the approved school which is attached to the National Children's Home, thus keeping some continuity with his previous background."

Case 3. Bob was referred because of many bouts of stealing and housebreaking. "... Bob was able to talk freely to me about his offences. These did not seem to have any factors more complex than the gain which comes from them. Psychiatric investigation has not revealed any information beyond that which is available in the ordinary inquiry into the background and circumstances of the family. I am unable therefore to offer any help in this problem in the form of treatment."

Case 4. Two brothers who were in court for stealing gooseberries. Removal from home was under consideration. "... In the present home life there is no woman who is responsible for caring for these boys. There is no one to wash them, bath them, comfort them, or to be concerned about their meals. Father and the older brother prepare their meals and the father is mostly responsible for the washing of their clothes. The school report concerning the older brother comments on the fact that he seems dirty and uncared for and that he never appears to be wearing decent clothes. Even by material standards these boys have suffered from deprivations, but their deprivations in the form of the absence of a woman, to give tenderness, understanding and a sense that they are good and worthwhile, are of an intensity that could not possibly be over-estimated. There is nothing in the offences with which these boys are charged that could not have been predicted as an inevitable consequence of the lack of suitable home conditions, of the ordinary necessities of child care, and of the amount of attention which builds up standards of behaviour in a child whose goodness is appreciated and nurtured. It would appear that it was too optimistic to expect the father to be able to provide this kind of care for his children at the same time as attempting to earn a living. Moreover, there is the inevitable tendency, in such cases, for the ordinary misbehaviour of ordinary children to be criticised unduly—because it is feared that it resembles the qualities in the mother whose conduct was so unsatisfactory. The danger of these processes is that the children in fact accept badness as their role and then tend to justify the criticism and condemnation which they meet on all sides. It is possible in such cases for the pattern to become so well established as to be beyond the reach of specialised treatment. It would be wrong in my view, however, to assume at this stage that the changes are irreversible. It would be equally wrong, in my view, to attempt to deal with the problem merely by exhortations to these children 'to be good' in circumstances in which their behaviour will inevitably appear to be bad. I would therefore respectfully make the following observations to the court: these children cannot safely be left in their present home conditions even with added supervision or treatment. In my opinion

> committal to an approved school would be likely to increase the feeling of rejection and unworthiness. Committal to the care of the local authority would appear to be a necessary step in any programme for helping these boys towards more normal development and psychiatric assistance through the Child Guidance Clinic is necessary for these boys in order to help them adapt to any new setting. An attempt should be made to keep the father in touch with these children even if they are placed in care. On his part he will need support, advice and encouragement which will be provided by the psychiatric social worker. Problems of behaviour will arise wherever these boys are placed and liaison between the Child Guidance Service and the Children's Department could help to prepare the individuals in whose care these boys are placed, before such trouble arises. Although the desired results would be by no means certain, it is my opinion that these boys have potentialities which justify the immense effort which will have to be exerted by a number of people if the court should decide to act on the basis of the observations outlined above."

Finally, we should like to end with a quotation from Macdonald (1958) which embodies our aims and represents much of our own experience: "Courts in my experience will give sympathetic consideration to psychiatric recommendations provided the psychiatrist devotes adequate time to his examination, exercises some modicum of professional skill, shows some understanding of the handicaps under which the court operates, and demonstrates that he is not the hired mouthpiece of either prosecutor or defence, but rather a sincere, independent and impartial witness."

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PRISON AND BORSTAL AFTER-CARE

ROGER HOOD

THIS year's report[1] is an interim review while "waiting for A.C.T.O." There is some welcome news such as the final provision of welfare officers in prisons, the W.V.S. voluntary helpers scheme for borstal boys, and the extension of pre-discharge planning to all women prisoners. Disturbing facts are also present. The report notes that the P.D. hostel scheme has not produced better results, and that material provisions of this sort are clearly not enough. Yet, what can be done when, in a number of places, it is stressed that an overworked staff with limited resources "must preclude all but superficial attention to the material needs of the majority of cases." Instead of blindly adding to the number of cases to be dealt with a real research effort should be made to identify those who most need, and will respond to, help. Limited resources need careful allocation. After all, is it expected that the 80 per cent. success rate for long-term prisoners will improve when the more-than-half who at present refuse help are statutorily given it?

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[1] *Annual Report of the Council of the Central After-Care Association*, 1961. H.M.S.O. 2s. net.

It is noted with pleasure that statistical data will in future also deal with work habits. But will borstal failure rates, in terms of the prediction scores, increase understanding or add to confusion as to their meaning? Now that the Commissioners neglect to show the proportion of "failures" who are reconvicted only once perhaps the After-Care Report could provide more detailed reconviction data. For example, how many offenders are still in trouble at the end of supervision?

THE RAINER FOUNDATION

On October 17, a luncheon, presided over by the Lord Mayor and attended by 250 guests, was held in the Egyptian Hall of the Mansion House, with the object of introducing this new title of the former London Police Court Mission and of launching an appeal for £250,000 to maintain and expand its work. The Right Hon. Lord Shawcross, in his speech, emphasised the importance of voluntary pioneering efforts in probing the problem and in pointing the direction for later government support.

In 1876, Frederick Rainer wrote to the Church of England Temperance Society, enclosing five shillings and suggesting that it might be possible to employ a prisoner's friend to guide those who came before the police courts towards a more useful and happier life; from this small beginning there developed the Police Court Mission and, sixty years later, the Probation Service.

Lord Shawcross expressed the gratitude of the Foundation to H.R.H. the Duke of Edinburgh, who had consented to become its patron. He went on to outline the activities of the Foundation: besides the well-known Cotswold Approved School, High Beech Probation Home, four other hostels and three temporary shelters for homeless young women, negotiations were proceeding for two more hostels and a new kind of hostel for girls as an intermediary between probation hostels and home or lodgings; also a home for pregnant girls of school age. Based on their experience with four pilot projects in adventure training for young offenders, the Foundation was about to purchase a permanent adventure centre in North Wales. A training scheme based on attendance on three evenings a week at a centre staffed by experienced social workers, helped by a team of voluntary workers of suitable skills and personality to engage the youngsters in remedial and recreational pursuits, was also planned. Finally, the Foundation was seeking to promote a pilot scheme of citizenship training for boys appearing before courts, as an alternative to approved school training.

" Although we are," he said, " the largest voluntary society in the country dedicated to the prevention and treatment of juvenile delinquency, our resources are woefully small and quite inadequate for the exciting new tasks ahead." It was estimated that a quarter of a million pounds was required to staff and provide for this deserving work.

P. D. S.

BOOKS & PERIODICALS

REVIEWS

SHOPLIFTING. A report on research carried out under the auspices of the Institute for the Study and Treatment of Delinquency by T. C. N. GIBBENS and JOYCE PRINCE. [London: I.S.T.D. 1962. 168 pp. 12s. 6d.]

FOLLOWING a suggestion of the late Dr. Denis Carroll, Dr. Gibbens, with the help of Joyce Prince and Dr. Phyllis Epps, has made a systematic inquiry into shoplifting.

The material of the study comprises all the men, women and children convicted of shoplifting during the year 1959–60 in three courts; a West End area, a suburban area with mainly local shopping and an outer suburban area which is a regional centre. In order to appraise trends in shoplifting, samples of men, women and children convicted ten years previously in the same areas were studied. Also control groups of other types of offender were used for the women and children. Dr. Epps' study is of 200 shoplifters admitted to Holloway Prison in 1959 and 1960.

It is difficult to summarise the work; the authors' conclusions occupy twelve pages which could not be further condensed without loss. It stands as an authoritative and extremely valuable addition to the literature. Its value lies in the thoroughness of the work, the representativeness of the sampling, and the breadth of the inquiry which, unlimited by an esoteric approach, includes social, physical and mental health, and psychological aspects of the problem. As such it enhances the value and brings into perspective the many, and usually smaller particulate studies of the past.

It has a significance beyond the chosen subject: it illustrates that there is still a great need for painstaking descriptive work and the collation of facts from many sources, independently of any premature hypothesis or theory; it illustrates also the futility of looking for a specific cause of a particular crime, and the importance, at the psychological level, of assessing the extent to which the immediate motive is "overdetermined or reinforced by other motives which decrease control"; the study vividly portrays the complex interaction of social and psychological factors.

For the rest the reviewer can only hope to whet the appetite of the reader, for whether he be physician, social worker, magistrate or even store proprietor, he will find much that is of practical significance.

Although shoplifting has greatly increased it has no more than paralleled the general increase in crime, and it fluctuates greatly in different areas.

Thursday is the peak day for women who steal clothes and Saturday for men. Male shoplifting differs in almost every respect from that of females; book theft is the commonest form of shoplifting in men and is confined to them. Au pair girls and students, rather than immigrants who come to stay, are the most frequent offenders among foreigners. Some doubt is cast upon the "difficult concept" of the professional shoplifter; the professional or persistent shoplifter behaves very much like the rest, pleads guilty as often and may well display an aspect of mental illness; she may soon gravitate to more lucrative techniques. Mental abnormality was very high in the prison shoplifters and an important factor in the others. Stekel's theory of a link between homosexuality and stealing is partly confirmed especially in young adult males. No case of truly compulsive shoplifting was found and fetishism was not closely related to shoplifting, nor were menstruation, the menopause or pregnancy considered important. Only seven or eight of the 532 women stole penis symbols (and two of these were umbrellas stolen when it was raining!). Sexual frustration, masochism, the need for excitement (especially of a forbidden nature), angry resentment and keeping up appearances, appeared significant motives. Great differences in motivation appear in the age epochs; the majority of teenagers and girls in their early twenties showed general social maladjustment, though in some the shoplifting expressed out-of-character neurotic difficulties; the twenty-fives to forties showed vigorous response to frustration, often sexual; depression was the hall mark of those between forty and fifty-five, while the oldest age group—the most difficult to interpret, commonly showed confusion and shame. Boys begin shoplifting earlier than girls but reach a common peak at fourteen; as compared with samples of boys and girls in remand homes, their backgrounds are rather less disturbed, they come from a higher social class and are now more likely to attend grammar or technical schools. Their shoplifting is often a displaced act of defiance, an appeal for help or associated with feelings of guilt, depression and worthlessness.

Daniel Defoe's London shoplifter of 1722, Moll Flanders, takes on a new look, but perhaps not so very new.

P. D. S.

DEPRIVATION OF MATERNAL CARE: A REASSESSMENT OF ITS EFFECTS. Public Health Papers, 14. World Health Organisation. Geneva. 1962. 165 pp. 10s.

MATERNAL DEPRIVATION: A CRITICAL REVIEW OF THE LITERATURE. By LAWRENCE CASLER. Monograph 80, Vol. 26, No. 2. Soc. for Research in Child Development 1961.

DR. BOWLBY's monograph "Maternal Care and Mental Health," despite severe criticisms, has had an immense impact in the eleven years since its publication. Although his cautious proposition that the *prolonged* deprivation of the *young* child of maternal care *may* have grave effects on his character and so on the whole of his future life, remains unshaken, yet the volume of further research makes reassessment a necessity.

The W.H.O. monograph is a symposium. There are five contributions to whet the appetite, followed by a substantial summing up by Mary Ainsworth.

Prugh and Harlow elaborate the subtle effects of the less obvious disruptions and distortions in the parent-child relationship which, even in the intact family, may have as devastating effects as gross physical separation. While the differentiation of disruptions from distortions is an advance, the attempt to deal at all adequately with the latter is likely to involve the entire range of psychopathology and so to become either unwieldly or incomplete.

Robert Andry examines the concept of maternal deprivation and outlines his work on the paternal role in producing delinquency. It is good to know that he is planning further research to include the much neglected delinquent girls.

Margaret Mead challenges the ethnocentric belief that an exclusive mother-child relationship is necessarily the most favourable, suggesting that we ought perhaps to be discussing not how much should a mother-substitute be like a mother, but how much can a mother be like a good nurse. She also suggests that diffusion of care among several figures may in certain circumstances be less fraught with danger

Lady Wootton condenses six specific criticisms of Bowlby's theory from her book, *Social Science and Social Pathology*, and Dr. Lebovici reviews the relevant researches.

Finally, Mary Ainsworth, in the light of recent research evidence, considers the main controversial questions raised by the other contributors. The concept of maternal deprivation, which hitherto has been loosely used to cover all sorts of undesirable interactions between mother and child, as well as breaks in the relationship, must in the future be broken into its components: insufficiency of interaction, a matter of quantity; distortion, a matter of quality; and discontinuity. Other controversy centres about the effects of single and multiple mother figures, variations in the degree of damage, specific versus general effects of deprivation, the permanence of effects, the question of "maternal" versus "environmental" derivation, and its relation of deprivation to delinquency. Future research should include longitudinal studies covering a variety of different elements of deprivation and a variety of substitutes for maternal care. Cases should be included from the higher socio-economic groups as well as from the more frequently studied lower groups, and non-western societies should be included. Attention should be directed to differential vulnerability and recovery rates, to degrees of recovery, to hidden impairment, and to the assessment of special processes thought to be most vulnerable (language, abstraction, inter-personal relationships and impulse control). Such studies may have to wait upon a more detailed knowledge of the normal course of development of these processes about which little is known, especially with respect to social development in the first three years of life. She concludes that "it seems unlikely that either separation or deprivation alone is the effective antecedent of delinquency, even in the 'affectionless' character, but rather that the antecedent is likely to be some special form of distortion in early parent-child relations, perhaps alone or more probably in conjunction with separation or deprivation experiences or both."

Despite the many references (Ainsworth alone has 128), there are some notable omissions, for example the work of Chess and his colleagues who found that primary patterns of reactivity appeared in infancy and persisted even after five years despite such stresses as parental death, separation and the birth of sibs. The importance of genetic or organic factors in rendering the individual vulnerable or in increasing the probability of rejection by the mother, receive little attention.

Lawrence Casler takes up the theme of the sensory, social and emotional elements in deprivation experience. In a most stimulating and original monograph he carefully analyses the work carried out on infants admitted to institutions before the age of six months. From this and from cultural data and animal experimentation, he concludes that the ill-effects found in children maternally deprived before six months of age probably have some other cause than deprivation of maternal love. "Evidence is accumulating both on the human and animal level, that this 'other cause' is perceptual deprivation—the absolute or relative absence of tactile, vestibular and other forms of stimulation." He further claims that these forms of stimulation can be provided within an institutional setting. He quotes recent work on hypothalamic and reticular mechanisms to explain the "critical period" phenomena and the importance of perceptual stimulation for normal development.

P. D. S.

CRIMINAL LAW AND PUNISHMENT. By P. J. FITZGERALD. [Clarendon Press: Oxford University Press. 25s.]

THE latest volume in the Clarendon Law series provides a concise but readable introduction to the substance and administration of criminal law. The arrangement of the book is unusual in that specific crimes are discussed before general principles of liability, but apart from this there is not much sign of original thought, except an interesting analysis of the defence of necessity. The most valuable features of the book are a discussion of the connection between particular legal principles and corresponding moral distinctions, and an attempt to relate different classes of offences to the social purposes which the criminal law is intended to serve. It is to be regretted that the author did not attempt the more difficult task of relating criminal law to modern criminology, but even without this the student is stimulated to a critical examination of some of the basic assumptions of the law.

The discussion of substantive law is by no means uncritical—Smith's case is duly castigated—but not all Professor Fitzgerald's views will command general acceptance. It is difficult to see why the criticism of the complexity of the law relating to malicious damage should not also be applied to the law relating to the fraudulent misappropriation of property. The anomalous situation in which a youth who has had sexual intercourse with a girl of fifteen can be deprived of his statutory defence by the prosecutor's decision to charge indecent assault instead of unlawful sexual intercourse surely calls for an amendment of the law; it is not sufficient to rely on the good sense and fairness of prosecuting authorities. The case for strict liability in "social welfare" offences is understated; mention of the third party procedure by which liability can be shifted to the party in fault would have resulted in a more balanced view.

The account of procedure and evidence is limited to a summary of the main features of the subject and is generally uncritical. The Court of Criminal Appeal is dismissed in one paragraph—a fuller discussion of the position of the court as the central organ of the administration of criminal law would have been useful.

The concluding chapter on punishment, which includes a brief discussion of the theory of punishment and the problems of sentencing as well as a short account of the penal system, does not make much use of the products of recent criminological research. Many readers will feel that the author's anxiety to present both sides of the argument over capital punishment has resulted in an understatement of the abolitionist case. There is, however, sufficient material in the chapter to start the student thinking about the problems involved in the treatment of offenders.

As in most books there are a few minor inaccuracies. Some of the offences described on page 40 are now contained in the Sexual Offences Act, 1956, not the Offences against the Person Act, 1861; in a case of unlawful sexual intercourse the defence of reasonable belief that the girl is sixteen is open to a man who has not been *charged* with an offence, not to a man who has not been convicted. These errors are insignificant, and despite the self-imposed limitations on the author's scope, this book is a useful introduction to the subject and a valuable addition to the student's bookshelf.

D. A. Thomas

DICKENS AND CRIME. By PHILIP COLLINS. Cambridge Studies in Criminology. Vol. XVII. [London: Macmillan & Co., Ltd. 1962. pp. xiii+371. 35s.]

As a source for the study of crime the novel has been neglected: if fiction is regarded as no more than a subjective but more or less credible description of human behaviour it is not difficult to understand how this neglect has arisen; but if the study of crime is viewed in the context of the analysis of concepts and social attitudes, then the novelist—in so far as he comments on the times he lives in, reflects articulately the outlook of his contemporaries or attempts to interpret his age—deserves some attention, at least in proportion to the influence of his work on the climate of opinion. In the instance of Charles Dickens this influence was considerable and pervasive; as man of letters, interested in social questions, he combined the psychological insight of a great novelist and the acute observation of an experienced journalist so that his writings form a rich sourcebook for many aspects of the social history of the nineteenth century at a formative period. In a painstaking and well-documented study, based as much on the journalism and letters as on the novels, Mr. Collins neatly disposes of the image of Dickens as a penological reformer and skilfully demonstrates how the at times radical zeal of the young Boz was transmuted into the almost reactionary fulminations of Mr. Popular Sentiment (as Trollope nicknamed him).

In some ways, perhaps, this exposure of Dickens's inconsistencies and, in terms of penal reform, retrogressive development is not quite fair since, from the time of his first visit to America in 1842, he was (to quote a phrase from Una Pope-Hennessy's biography) "saddled with a reformer's reputation and was expected to live up to it"; indeed it is doubtful—particularly since the publication of Humphry House's brilliant study—whether a claim could be made for Dickens to have pursued the cause of reform consistently throughout his life in relation to any controversial social issue, except perhaps the reform of the chancery courts and the poor law. In point of fact many of the reforms sponsored by Dickens were only engineered after his death or, at best, many years subsequent to the launching of his original literary assault; for example, the abolition of public executions was not brought about until 1868. Certainly, tracing the development of Dickens's attitudes to crime takes us for fascinating excursions into a landscape less criminological than literary, and as such equally controversial. On the one hand, the latently aggressive element of Dickens's temperament led him to favour deterrent remedies in the treatment of offenders while, on the other hand, his perhaps unconscious identification with the criminal enabled him to create characters such as the psychopathic dwarf Quilp in *The Old Curiosity Shop* and Bradley Headstone, the murderer, in *Our Mutual Friend*. The ambivalence of Headstone—decent schoolmaster and jealous lover—illustrates an ambiguity incorporated both in Dickens's own attitudes (for example, to the police) and in Victorian society as a whole. As House remarks, "There is an open sincerity in his manner when he is attacking injustice, cruelty, humbug, and so on, which is lacking when he attacks the cruder consequences in sex, drink, and dirt, of bad social conditions." It must be admitted that in considering the deeper implications, moral and psychological, of crime Dickens stops where Dostoevsky begins.

Although he became embroiled in the controversies of his time about the respective merits of the Silent, Separate and Marks systems of prison management, Dickens was generally more content to describe social problems, even as a passionate witness inspired by humane motives, than to suggest solutions to them. One of the more entertaining chapters in Mr. Collins's book, however, is concerned with Dickens's interests in Urania Cottage, a home for "fallen women" in Shepherd's Bush, where his practical bent seems to have been realised and commonsense notions fulfilled. Dickens himself appears to have selected many of the girls for admission (the home accommodated thirteen), appointed the staff and supervised many details of the conduct of the establishment. There were, of course, difficulties: with the staff—one of the superintendents is "rather of a delicate gentility, I fear; and her aspect is sombre": and with the girls—Jemima "forced open the door of the little beer cellar with knives, and drank until she was dead drunk; when she used the most horrible language and made a very repulsive exhibition of herself." The results were encouraging in the earlier stages, and the venture may have profited from Dickens's attitude to juvenile delinquents towards whom he was more generous than to adult criminals; in his next book Mr. Collins may have more to say about the relationship between juvenile crime and education (or the lack of it) which inspired so many early Victorian pronouncements on this subject. On the reverse side of the medal, Mr. Collins makes a comment —in relation to Dickens's comparison between prisons and workhouses—on the operation of the principle of less eligibility; in his demand for penal hard labour and in his view that it was unjust to teach prisoners trades or let their products compete with those of honest artisans, Dickens was, as Mr. Collins points out, running counter to informed penological opinion of the 1840s and 1850s. It was, perhaps, not without a touch of irony that the reactionary Prisons Act of 1865 ante-dated Dickens's death by five years.

John Croft

CRIME IN OUR TIME. By JOSEPHINE BELL. [London. Nicholas Vane. 1962. 239 pp. 21s.]

No author is entitled to expect readers to value her common sense comments or cameo case histories where these are interspersed with legion, verifiable, inaccuracies. In this book one finds such unforgivable statements as "In criminal cases there can be an appeal against conviction from the High Court to the Court of Appeal." Describing the work of lay magistrates at petty sessional courts Dr. Bell says that they "sometimes sit with a jury but more often do not."

In this same strange world of magistrates' courts "an offender may, if deemed innocent or nearly so, be given an absolute discharge." Dr. Bell, *inter alia*, does not appreciate the use of detention centres in the sentencing armoury of the courts. A loose, racy style ("to conclude this work I am going to stick my neck out still further") leads her to describe an "almost accidental murder."

What disillusion one experiences to watch a poised and favourite detective fiction writer floundering in an unfamiliar sphere.

Jean Graham Hall

DISTURBERS OF THE PEACE. By T. L. IREMONGER, M.P. [London: Johnson. 1962. 192 pp. 25s.]

THE assumption that people distrust experts on penal questions but will listen to an enthusiastic amateur does not commend itself to this reviewer. Nothing new transpires in this book, but the author, somewhat tortuously, explains how he reached the same conclusions as those who have worked in the field for many years and couple wide experience with research. The special psychiatric prison at Grendon Underwood has now opened, and further enthusiasm for the East-Hubert conclusions is to be welcomed. Perhaps "young thugs" is an improvement on the description of "borstal lads"—but I doubt it. The main value of this book is that the beginner may venture from here into a fuller and fruitful field of available literature.

Jean Graham Hall

THROW AWAY THY ROD: LIVING WITH DIFFICULT CHILDREN. By W. DAVID WILLS. [London: Victor Gollancz, Ltd., 1960. 159 pp. 18s.]

THIS important book is a personal testament, a statement of the beliefs and practices of one who for eight years had been head of Bodenham School for maladjusted children. Its pages are innocent of graphs and tables for it does not purport to be a scientific inquiry; there is no index, no bibliography, and references in the text to original sources are few and far between. For all this its message rings loud and clear, and with the ring of truth that may be instantly perceived by all who have shared, however modestly, the author's experiences with unhappy children. Most of the boys at this school were sent there because they had been caught stealing, or injuring other children, or were beyond the control of their parents, backward or antisocial. The average age was 10½ and they stayed for as long as five to six years at an annual cost of £425. Nearly a third were bedwetters and one in ten was a "failed adoption." Out of this unpromising material a therapeutic community grew, and the story of its growth, and the lessons it had to teach, are attractively presented. One of the main difficulties facing those who are responsible for schools for maladjusted children is, as the author points out, "to prevent them from being staffed entirely by maladjusted adults." But there are many other difficulties besides and success often seemed strangely elusive. Even so, this book will be in the hands of all who work with maladjusted and disturbed children. That it will one day be judged one of the classic contributions to this subject is beyond doubt.

J. A. Waycott

THE MIND OF YOUR CHILD. By DORIS ODLUM, M.A., M.R.C.S., L.R.C.P., D.P.M. [London: W & G. Foyle, Ltd., 1960. 108 pp. 4s.]

PARENTS and teachers have had a rough time since the easy days of Truby King because they have been on the receiving end of a ceaseless torrent of advice, marked by a bewildering lack of consistency, about handling their children. Here and there one can snatch something worthwhile, something, for example, that increases awareness and understanding of the dynamic growth of the human personality without, at the same time, leaving behind a sense of hopeless failure and guilt. This little book, written by a psychiatrist who has given much thought to this kind of communication, is a simple account of the mental components of growing up that is specially shaped for those who come to the subject with untutored minds. This calls for a somewhat superficial approach and an avoidance of dubious theories, but the author has succeeded in covering a great deal of ground with the ease that comes from mastery of the subject. Such a book, packed as it is with warmth and wisdom, deserves a place on the shelf of any one who works with children and cares to know them better.

J. A. Waycott

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EDITORIAL

MR. WILKINS, in his article on criminal statistics, begins by quoting Lord Kelvin, to the effect that, when measurement is not possible, knowledge is of a meagre and unsatisfactory kind. Fortunately the development of criminology as a science has not been arrested by deficiencies in criminal statistics; from the very beginning, clinical studies of offenders added considerably to knowledge and as research techniques have become more sophisticated the data have yielded better and more useful results, contributing significantly to the growth of theory.

The most serious obstacles have been met by those criminologists who have sought to study the incidence of crime, and to correlate it with other social facts or with features of the social structure. Although the iceberg phenomenon in which the ratio of unreported to reported crime is unknown has long been recognised, many sociologists and most legislators have pressed on regardless to make generalisations based on crimes known to the police or persons found guilty which might for all we know be quite invalid. If one were to pursue the navigational analogy it might be said that existing crime statistics are like a compass which has not been corrected for metallic interference in the ship. The difficulty is to estimate the degree to which a whole series of factors throughout the process whereby crime is committed, reported, detected and punished, influence both information and definition. It has been fashionable for some time past to treat crime statistics as the worst of all social statistics, but, as Wilkins points out, the figures may not be measurements of crime, but as numbers representing *what they claim to represent*—crimes known to the police, persons found guilty and so forth—they cannot fairly be impugned.

The situation is not altogether hopeless and, as he goes on to show, crime indices, while not easy to construct, are not beyond the limits of statistical expertise. Legal categorisation is one stumbling block when, for example, " robbery " can include adult bank robbers and small boys who bully younger boys in the school playground. But the most serious difficulty, Wilkins suggests, is that at present there are both static and dynamic aspects in criminal statistics, and it is not possible to separate them from each other.

Psychologists are often condemned—sometimes justifiably—for their inability to produce something slightly bigger than a mouse or indeed something which has general practical applicability. Dr. Haward in his article shows that it is possible for psychology to make a practical and major contribution to criminology. With great clarity he demonstrates the effects that distortion in the oral evidence of witnesses can have upon an unsuspecting jury, the court and the public, still insufficiently aware of the fickle nature of memory, misperceived messages and the mechanisms of learning. Accordingly, it is possible, in response to the same evidence, for one juryman to swear that what he has just heard is the equivalent of white and for another to swear justifiably that it is black, since each perceiver creates his own perceptual world according to such principles as expectancy, emotional pressures, physiological needs, etc. A stern or bespectacled witness, as distinct from a smiling one, has thus been known to influence the attitudes of various members of the jury differently in relation to a supposedly objective testimony. That the social status held by the foreman can have a very subtle influence on his jurymen with their varying personalities and backgrounds is never underestimated by the expert who has made a study of the interaction of group dynamics.

Dr. Haward rightly instances three main complementary types of approach: the laboratory experiments (*e.g.*, of Bartlett on memory), the mock-trial experiments (*e.g.*, of Strodbeck), and his own which consist of recording actual court proceedings and then conducting standard interviews with the jury and witnesses afterwards to measure the amount and kind of misunderstanding between the two. All this is easily fitted into the already-existing framework of psychology but applied specifically to this neglected field in criminology.

Dr. Haward's article is thus likely to satisfy both the experts in his own field and those in others who together make up the heterogeneous body of inter-disciplinarians constituting the readers of this journal. It is hoped that he has laid himself open among his readers to little of the very misconception he is talking about, and that his own clear exposition will act as a stimulus to further research in this still barren criminological corner, and to possible changes in the law, if necessary. Sooner or later criminologists will have to decide whether the present jury system is sound or an anachronism—perhaps in need of replacement by a selected panel of experts. However, before possible interference with this cherished principle of British justice a great deal of research will be required.

Mr. John Mack raises again the controversial problem of the role of the police in juvenile delinquency. The Ingleby report commended the aims and achievements of the schemes, but withheld a general blessing, largely because it was felt that the work required trained social workers. In matters of treatment, at one end of the scale is the village policeman who "without formal contrivance" tries to keep his flock in order, and at the other is the policeman in his attendance centre, backed by the law in carrying out quite a complex treatment process. It is not the case, therefore, that the policeman is required to stick to his role of prevention and detection, but rather that anxiety is felt when he selects his own cases, and applies a not clearly specified treatment technique without having had special training and without outside surveillance. In the case of the Liverpool scheme, 42 per cent. of the children had not committed an offence so that the argument that liaison work is applied " only in cases where the offence is admitted " is not very relevant. One does wonder what the policeman did with the two Greenock children whose problem was running away from home.

Mr. Mack objectively and convincingly presents the other side of the argument. While there is clearly much to be said on both sides, most would agree upon two points: of the stated alternatives it would be preferable to increase co-operation with other social services rather than to expect that training " would probably follow " if the schemes prospered; Mr. Mack's example of investigating the problem objectively should surely be followed. We are, after all, only just beginning to press for scientific assessment of the results of such heroic methods as removing young children from home let alone allowing a policeman to do what he can with the child at liberty.

The recent literature, mostly American, on the criminal subculture represents one of the most stimulating post-war contributions to criminology. One of its weaknesses is that much of it has so far been based on conjectures not adequately backed by research. It is only now that these conjectures are being tested by a few carefully designed investigations. One of the latter is in progress in this country (see the outline in *B.J.C.*, Vol. 1, p. 376). Another is described below in the Note by Professors Franco Ferracuti and Marvin E. Wolfgang. Its principal hypothesis, to be checked by the application of various psychological tests, is that while the dominant, upper and middle class, culture is essentially a non-violent culture the lower social classes are divided into a large portion accepting the same non-violent pattern and another portion where violence is regarded as a normal pattern. This, it is further hypothesised, does not rule out the possibility of individuals belonging to the non-violent culture committing acts of violence for reasons unconnected with the dominant culture, or of individuals belonging to the subculture of violence being non-criminal. It is hypothesised, however, that individuals acting against the dominant culture to which they belong will show a more pronounced abnormality in their personalities than individuals who act in conformity with their dominant culture pattern. The research will be carried out on samples collected in Puerto Rico, and the research workers emphasise its limited scope. It would no doubt be desirable if corresponding studies could be undertaken in other countries, too, to enable us to compare the results and to make them more widely representative in case of identical findings.

THE MEASUREMENT OF CRIME*

LESLIE T. WILKINS (*London*) †

IT is not inappropriate to remind ourselves of the frequently quoted words of Lord Kelvin: "When you can measure what you are speaking about and express it in numbers you know something about it, but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind." [1]

How does Lord Kelvin's dictum apply to criminology? Can we measure crime and express it in numbers, or is our knowledge of a meagre and unsatisfactory kind? Certainly there are numbers in plenty in *Criminal Statistics* and other publications, but do these measure exactly "what we are speaking about" when we speak about "crime"? All too frequently in all walks of life figures are quoted which bear some resemblance to "what people are speaking about" but do not relate to it specifically and precisely. Whether or not the numbers relate specifically to "what we are speaking about" has nothing to do with the qualities of numbers as such, but this seems to have been overlooked by some criminologists. Sutherland and Cressey (1955) say of *Criminal Statistics*, "The general statistics of crime and criminals are known as the most unreliable and difficult of all statistics. . . . This unreliability stems from the fact that it is impossible to determine with accuracy the amount of crime in any jurisdiction at any particular time." But the difficulty is not a statistical difficulty, it is a difficulty relating to problems of perceptual processes. There are a large number of points at which it is possible to intercept events or persons and to make counts of them.

Figures are available for "indictable offences known to the police," figures are available for the numbers of persons proceeded against, there are figures for persons found guilty and many other sets of figures. Are these figures measurements of "crime"? Undoubtedly not. But as numbers *representing what they claim to represent* they are not necessarily to be impugned as "most unreliable." It is not that the statistical data claim to be what they are not, but rather that the people who make use of them are often "unreliable." This argument does not mean that there are no difficulties of a statistical nature. There are two different types of problem. Whether the figures are what they claim to be is one problem; whether they represent "what we are speaking about" is a different problem. It is necessary to keep these problems separate in our minds if we are to make any progress towards the solution of either.

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* Based on a paper given to the Royal Statistical Society Conference on Social Statistics at Cambridge, April 1962.

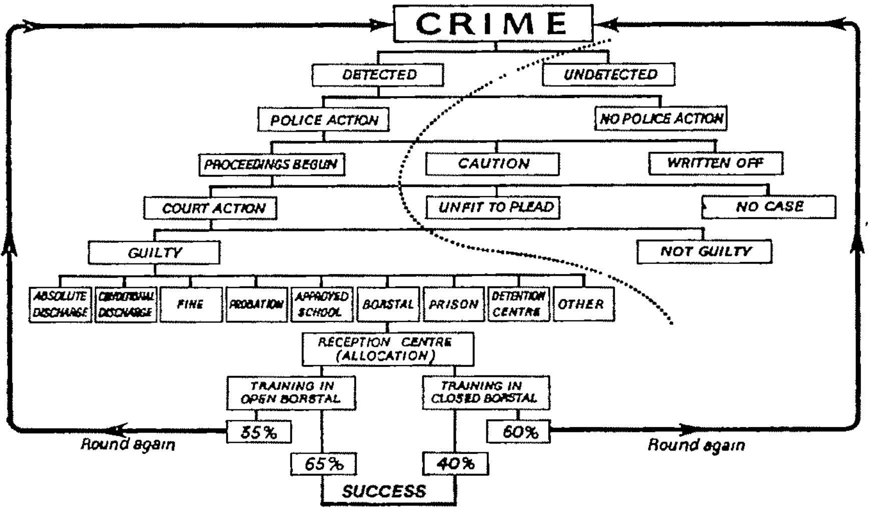
† Deputy Director of Research, The Home Office; at present Ford Foundation Research Fellow in Washington, D.C., attached to the President's Committee on Juvenile Delinquency.

[1] As quoted on frontispiece of *Tables for Statisticians*, Pearson, London, 1955.

It was once said of a certain person that he used statistics as a drunken man used a lamp-post, for support rather than illumination. Such practices are not unknown in the history of criminal statistics.

FIG. I

An Abbreviated "Flow" Chart



The processes in which criminologists are interested are dynamic processes. From the commission of an offence to the reception of a convicted offender in a penal institution there are many stages. At any one of a large number of points along this process *continuum* we may intercept persons or events and make counts. Some indication of the nature of the processes involved is given in Fig. I. Each of the branching lines indicates a point of decision or action and, since persons make these decisions and are affected by them, these can be recorded and counted. Whether a record of any or all of these decisions at any or all of these points, or even the other points which could be indicated, would be a measure of " what we are speaking about " when we speak about " crime " is debatable. Probably, then, it would be quite in order to continue Lord Kelvin's phrase and to infer that when we speak about crime our knowledge " is of a meagre and unsatisfactory kind." But this may be an indictment of our processes of thinking and speaking about crime rather than of the method of collecting numbers and measurements.

It is obvious that counts and measurements at different points along the process *continuum* give different numbers and that these different numbers measure different things. There is, however, apparently in the minds of some persons a concept that they term " crime," and this is for them a unitary concept, whereas the processes of social defence are reflected in many different measurable and countable things. It may be desirable to examine some of these distinctions.

Crimes and Criminals

It will be apparent that figures relating to " crimes " and figures relating to " criminals " are different and relate to different things. It is remarkable, however, how often these concepts are confused by persons who seek to interpret criminal statistics. It is necessary to remind oneself continuously of this important distinction. A crime can occur without there being a criminal, and a criminal can commit a number of crimes in the course of one event or action. For example, crimes committed by persons under the age of criminal responsibility are, in one sense, crimes without criminals. If a crime becomes " known to the police " but is not detected, there is always a chance that it may be a crime-without-a-criminal. There is a crime for every criminal, but there is not a criminal for every crime. The implications of this slight complexity are far-reaching. It means, for example, that there is no way of measuring how much juvenile delinquency there is in an area or country, but only detected juvenile criminals. Clearly the age of an offender cannot be known until the crime is " cleared up."

Problems of Reliability of Criminal Statistics

It will be clear that figures collected at some points along the *continuum* from the commission of the offence to the disposal of the offender are likely to be more reliable than those collected at other points. In general, it is suggested that figures relating to persons are more reliable than figures relating to events. For example, the number of persons who are received into prison under sentence in any one year is a figure which it is possible to know exactly, as also is the figure relating to the population of any or all of our prisons on any day. There will be problems as to what is meant by " prison," and perhaps what is meant by " persons " and what is meant by " under sentence." But these terms may be dealt with by operational definition. Nonetheless, such numbers, even although absolutely accurate, do not necessarily relate to " what we are speaking about " unless we are careful to speak in exactly the same terms as those used to determine the counting procedure. A concept which is not definable is not communicable and, therefore, not measurable.

Thorsten Sellin (as quoted by Sutherland and Cressey, 1955) has stated that the value of a crime rate for index purposes " decreases as the distance from the crime itself in terms of procedure increases." That is, Sellin believes that records of " crimes known to the police " are more reliable as an index of crime than are figures relating to arrests, persons proceeded against or found guilty, or various figures relating to disposal of persons after trial in the courts: or, reminding ourselves of the major distinction between statistics relating to persons and those relating to events, Sellin suggests that the most meaningful figures from the criminological point of view are those relating to events (crimes) and not those relating to persons. This seems a doubtful proposition. A person is simply defined by his own physical identity. If a person passes through a certain gate, whether this be the physical gate of a prison or some other " gate," and that gate has a counting mechanism, there cannot be much doubt about persons/gate passages. But immediately an event is imagined independent of a specific person and a specific " gate " mechanism, or a concept is discussed which does not relate to a specific activity or decision which can be observed, there is far more chance of uncertainty.

It is, of course, immediately apparent that the police do not become aware of crimes by some mysterious process of " knowing "; nor do they get to know about them by direct observation if the criminals are able to avoid it. Crimes " known to the police " are usually reported to them by the public, most frequently by the victims. This means that an event must first of all be *defined by a member of the public* with no special legal knowledge, both as a " crime " and as such a crime as to justify his telling the police about it. It may be that what is defined by an ordinary citizen as a " crime worthy of notification " may not be a crime within the legal code of the country concerned and, although the event is notified because it is perceived as such, the police will not record it. On the other hand, there are many events known to the same citizen which he does not define as *worthy of notification*, or which he does not even define as or know to be crimes.

It would be possible to define " crime " operationally as any event known to the citizens of an area and *thought* by them to be worthy of notification to the police in the expectation of police action regarding the matter. This would amount to defining crimes as events which give rise to a level of disapprobation on the part of the public such that they actively seek the assistance of the forces of social defence. At present, however, the figure of " crimes known to the police " relates to an *amended record* of events believed by the public to be crimes. It cannot include crimes not reported for whatever reason, nor will it include reports that relate to events which are not statutorily defined as crimes. If, in any society, there are a large number of events which the ordinary citizen defines as worthy of police action but which are not so defined in law, it is almost certain that the society (if it is a democracy) will amend the law to agree more closely with the factors of public disapprobation. As an example of public disapprobation of this kind leading to new legislation, one may consider the Offensive Weapons Act, which made it a crime for persons in Britain to offer for sale certain types of knives.

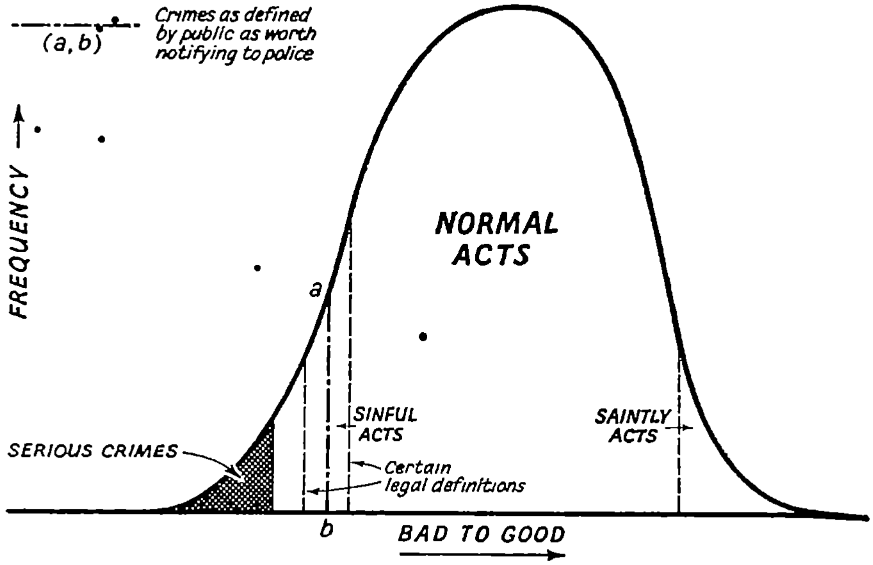
Legal definitions of crime, while doubtless very suitable for legal processes, are not directly translatable into sociological indices. Included in what is usually regarded as normal behaviour are some acts which are crimes by legal definition, while at the extreme end of a distribution are crimes which all sane persons, even offenders themselves, regard as such.

Crime is human action, and it is convenient to try to set up a verbal model of actions which will help in discussing the question of measurement of crime. It is possible to picture human actions as forming a frequency distribution of actions—a continuum from very saintly acts to the most sinful, or from acts incurring the greatest amount of public disapprobation to acts attracting the greatest degree of public acclaim. There are very few extremely saintly acts committed in the world, and there are very few extremely sinful acts; the majority of our actions are just normal, *i.e.*, they do not represent any extreme of good or bad. In fact, it does not seem unreasonable to postulate that, if we could measure the degree of saintliness or sinfulness of actions, the ethical content would be normally distributed in much the same way as we arrange for the various measurements of I.Q. to be normally distributed. The all-too-familiar normal distribution is illustrated in Fig. II. If we are prepared, for purposes of argument, to accept this model as representing the distribution of the ethical content of human actions, crimes would be represented, in the main, by actions at the " sinful " end of the scale. But the point of cut-off between " crime " and " no crime " is of importance in counts of the frequency of notifications of crimes to the police. At this stage it is possible to introduce another consideration. It is often represented that the main " cause " of the current " crime wave " is the drop in moral values of present-day society. If this argument is not circular, is it a fact that today the average citizen is more likely than in any previous years to become a victim of a criminal attack upon his property or person?

As has been noted, before an incident is included in the " crimes known " figures, it has to be both *socially* defined as worthy of

FIG. II

Postulated distribution of human actions according to moral evaluation, showing cutting points at certain legal and other definition levels


(a, b)
Crimes as defined by public as worth notifying to police
FREQUENCY
NORMAL ACTS
a
SINFUL ACTS
SAINTLY ACTS
SERIOUS CRIMES
Certain legal definitions
b
BAD TO GOOD

notification, and defined by the police as a crime in the technical meaning of the term. It would be expected, for example, that quite a few incidents of vandalism are defined by the public as worthy of notification, but these are not in fact crimes and do not find their way into the criminal statistics. On the other hand, there are many thousands of incidents of shoplifting which are certainly " crimes " but which are defined by the victims as not worth reporting. There is ample scope for definitions to vary both from place to place and from time to time without any change in the underlying situation.

Any change in the social definition of an event worth notifying to the police will, even in completely stable conditions, influence the bias of the sample of crimes represented by the " crimes known " figure. It is, indeed, possible to argue that if our moral standards are improving—that is to say, we are becoming more stringent and require more conforming standards of behaviour—the definition of the social concept of crime that should be notified to the police will tend to agree more closely with the legal definition so far as the majority of crimes are concerned, since by far the greatest component in the " crimes known " figure is that of larceny. In terms of the model of Fig. II this would mean that the line *a—b* would move further towards the right, so that more of the area under the curve would be taken in. The size and shape of the curve need not change. As Lodge (1953) remarks, " only large changes or persistent trends can be relied on with any degree of safety to have a cause which it is worth while to investigate. There should be borne in mind the possibility of factors such as improved police methods, greater readiness on the part of the public to report an offence, or other such changes." While statistics of crimes are very difficult to interpret, statistical data relating to offenders who appear before the courts are recorded with substantial accuracy. Taking a very broad view and using all the information available, it is only fair to say that the crude figures of " crimes known to the police," which have been quoted in many quarters to indicate a substantial increase in crime rates of recent years, do in fact represent some real increase. It is somewhat more certain that particular age groups are causing justifiable concern.

Crime and Indictable Offences

The definition of an indictable offence depends on the way in which an adult person accused of an offence may be tried. Special provisions for persons under seventeen years of age are ignored for purposes of definition. In England and Wales the police record as " crimes known " only offences regarded by them as indictable. This excludes offences where there is a specific statutory provision for them to be dealt with either on indictment or summarily—that is, " hybrid offences." Perhaps when this criterion was devised the distinction between indictable and non-indictable offences was a reasonable one and related to some measure of public disapprobation. Today it seems a little out of accord with public opinion. It may be that continuity of statistical indices is important and that public opinion should not weigh too much in considerations of change. Nonetheless changes are introduced into the legal structure by reason of technological change which no attempt to retain comparability with the past can withstand. The horse was a factor to be considered in relation to criminal behaviour in the past, but it is very doubtful whether the transition from horse to horseless carriage is a sufficiently direct one for the continuity of legal definition and statistical counting tied to those definitions. For legal purposes, and not without good reason, there is a tendency always to try to make the existing structure suffice for the newer conditions for as long as possible. On the other hand, social research and sociological inquiry require indices which reflect the current structure of society. However, it may be argued that statistical continuity should also be sustained for as long as possible, but how long that is is subject to widely varying opinion. Changes in the law and related statistical data can be made only by discrete steps, while social and technological changes are a continuous process. Some items must, by reason of this fact, be out of step no matter how often revisions are made. These gaps must be supplied by those who interpret the figures. For example, between the years 1954 and 1955 the offence of malicious damage to property dropped from 5,156 to 2,123. It is perhaps sufficiently obvious that the sudden drop in this category of offences is due to changes in the system of recording these offences. The discontinuity is apparent when we examine the detailed figures, and there is no satisfactory way of correcting or adjusting for it. The discontinuity of one sub-set of figures has, of course, an influence on the total or any other figures which include this sub-set.

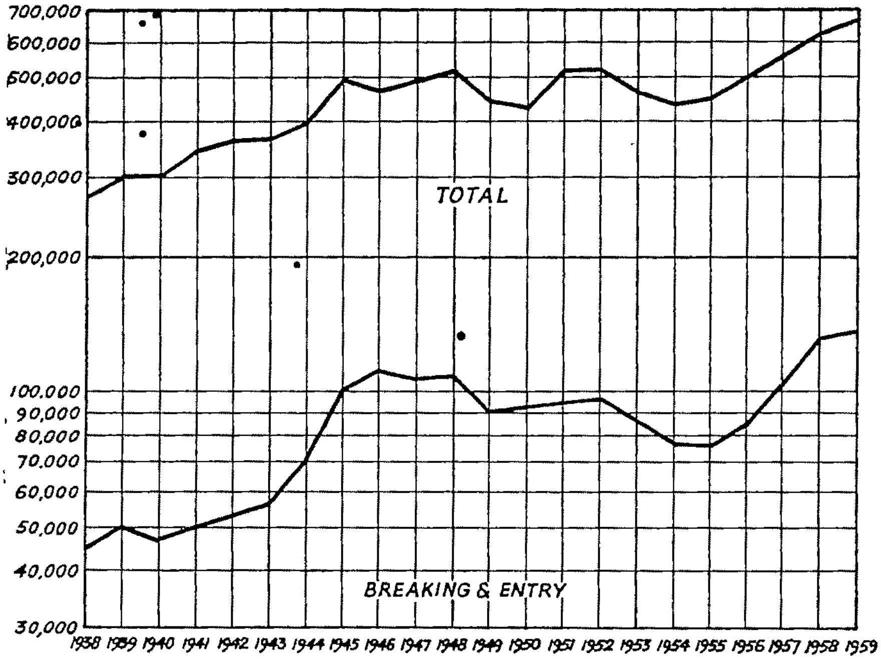
A further difficulty in looking at crime figures over any period of years, which may at first sight seem simple to adjust statistically, is the fact that the population of a country or state changes. The total amount of crime will also be expected to change because, if there are more people and the definitions of crime remain constant and are constantly interpreted, more persons would be expected to commit more crimes. But is it sufficient merely to adjust for this factor by dividing crimes by the population? Is a meaningful crime rate provided by an allowance for the greater amount of crime expected if there are more people to commit it? Clearly it must make some difference, and the rate per 100,000 of the population (the conventional index) is a better index than the actual number of events making no allowance for the population size. But the majority of crimes are committed, so far as is known from the persons identified as criminals, by younger male persons. Females commit little crime and persons over the age of thirty are far less likely to be found guilty of offences than are people under thirty. So, if only the population age structure were changing, if there were more young people in the population, then even with a constant population an increased crime rate would be expected. The converse is also true. If a population is becoming on average older, the crime rate would be expected to drop, even if every person, age for age, were as criminally inclined as before.

Taking all points together it seems very unsafe to make any statements regarding the *state of crime* over different years or as between different countries, counties, states or districts, except in the crudest possible terms. It would, of course, be possible and interesting to calculate an age standardised crime rate, which made an allowance for the crime rate expected at each year of age, and to relate this to the population and the incidence of reported crimes. (See Wilkins, 1961.)

But such a standardisation would have to rely on figures relating to *persons found guilty*. To extend inferences from *persons* to *crimes* begs a whole series of questions regarding the number of crimes cleared up for each age and many other difficulties which seem at present to be insurmountable. It is, for example, not unreasonable to suppose that young offenders are more likely to be caught, but there is no way of knowing how much more likely. It will be clear that the provision of a general crime index presents many difficulties; nonetheless people are prone to make statements in a general way about the volume of crime. It is possible to suggest some crimes the figures for which are less affected by the difficulties to which reference has been made than the total of all " crimes known." It has been suggested that the number of offences of " breaking and entering " provides such a good general measure because this group is restricted in its coverage, the definition is less likely to change with time and the action itself is less likely to be seen differently by different persons. It may be argued that if crime (in the criminological sense) is increasing in total, the parts must be also, and thus, if breaking and entering offences are increasing, then other offences will be also. A comparison of the trends for offences of breaking and entry in relation to the total of " crimes known to the police " is shown in Fig. III.

FIG. III

Comparison of trends for offences of breaking and entry in relation to total of " crimes known to the police "



To a considerable extent the two sets of data support each other. But it is interesting to question whether all types of crime are likely to go up or down together. If they do, then it does not matter very much which type of crime is selected for the crime index, nor indeed whether all crimes known to the police are taken together.

Towards a Crime Index

Table I sets out the numbers of certain crimes known to the police adjusted for population changes for the years 1946–1959. It will be seen on inspection that the murder rate does not vary in any close relation with other crimes; years which had high murder figures were not high for burglary, nor were there any variations in the murder rate in excess of chance. But years which were characterised by high figures for burglary tended to show also high figures for housebreaking. It seems probable that correlation analysis might be of some value in studying the problem of crime indices. Using the figures for the periods 1927–1938 and 1946–1959 fifteen types of offences usually regarded as serious crimes have been inter-correlated.

TABLE 1

Certain Indictable Offences known to the Police adjusted for population changes (England and Wales) (base year 1946=actual figures)

Year	*Murder**	*Burglary*	*Embezzlement*	*Housebreaking*
1946	131	4220	799	31270
1947	134·5	3872	1052	30285
1948	146·3	4153	1732	31417
1949	118·1	3712	1734	26770
1950	121·2	3592	2153	26057
1951	122·4	3711	2333	26164
1952	134·7	3811	2894	28195
1953	129·2	3659	2842	26479
1954	134·5	3126	2981	22782
1955	121·5	2862	2833	21435
1956	142·7	2836	3091	22705
1957	144·6	3516	2563	27775
1958	118·2	4316	2756	34569
1959	134·6	4387	3533	35874

* Uncorrected for cases subsequently found to be manslaughter, infanticide, etc.

The matrix of correlations is shown as Table 2. It will be seen that there is some tendency for murder to be associated positively with some offences and negatively with others. There is, however, no strong association between patterns in the murder rate and the patterns for any other offences. The same applies to attempted murder and manslaughter. But these three types of offences show different patterns of change from each other and also from almost all other types of offence. Manslaughter shows a fairly high correlation with housebreaking, but no correlation at all with either shopbreaking or robbery. Some of these correlations are of interest in considering the structure of a crime index. Clearly in the case of murder a crime rate based on any other crime would not give any information—the best estimate of the number of murders in any year is the average. Thus it is possible to say that a " murder rate "

TABLE 2

RELATIONSHIPS BETWEEN TRENDS IN DIFFERENT CRIME RATES, ENGLAND AND WALES

	Attempted murder	Manslaughter	Felonious woundings	Malicious woundings	Assault	Buggery	Attempted buggery	Indecency between males	Rape	Indecent assault	Unlawful intercourse	Burglary	Housebreaking	Shopbreaking	Robbery
Murder ·	·45	·10	–·42	–·15	–·15	–·20	–·36	–·29	–·11	–·28	–·28	–·03	–·09	–·09	–·09
Attempted murder	·	–·20	–·35	–·20	–·20	–·05	–·26	–·18	–·01	–·19	–·31	–·19	–·08	–·07	–·07
Manslaughter		·	·24	·34	–·02	·22	·42	·03	–·13	·28	·24	·11	·66	·27	·14
Felonious woundings			·	·82	·46	·70	·86	·75	·52	·84	·78	–·24	·04	·10	·30
Malicious woundings				·	·46	·75	·87	·80	·55	·87	·93	–·26	·09	·09	·20
Assault					·	·23	·46	·32	·25	·34	·55	–·20	–·18	–·20	·21
Buggery						·	·77	·81	·42	·77	·68	–·56	–·20	–·19	–·06
Attempted buggery							·	·88	·43	·88	·61	·45	·79	·05	·19
Indecency between males								·	·38	·79	·72	–·45	–·02	–·02	·11
Rape									·	·67	·62	–·60	–·36	–·30	–·28
Indecent assault										·	·86	–·41	–·09	–·09	·06
Unlawful intercourse											·	–·36	·01	00	·12
Burglary												·	·73	·67	·61
Housebreaking													·	·95	·66
Shopbreaking														·	·62
Robbery															·

Correlations over 0·80 are underscored.

and a " crime rate " are two entirely different things and bear little or no relation to each other. It would seem reasonable to require that for a rate to be meaningful the items included in it should not tend to mask each other in terms of their variations over time. The specific point made in connection with murder seems valid generally as a point for consideration regarding other aspects of crime rates.

Despite the logical difficulties some grouping together of different types of offences in a crime rate seems essential. It does not assist the appraisal of figures to have more than is necessary; and separate rates for each crime, although useful for some purposes of analysis, will not serve for sociological investigation of general trends. It may seem reasonable to add together crimes which behave over time in a similar way, and the correlation analysis will assist in determining which offences may be taken together and which should be treated separately. In the correlation matrix, correlations in excess of 0·80 have been underlined. Not unexpectedly shopbreaking and housebreaking tend to move together; burglary does not go with either in any significant way, but is more related to the group of breaking and robbery than to any other. Thus it may seem reasonable to group together shopbreaking, housebreaking, burglary (breaking by night) and robbery. It also seems reasonable to group together both sexual crimes and violent crimes, except perhaps assault. Murder, attempted murder and manslaughter might have been considered, subjectively, to be a good grouping, but this is not supported by the analysis. There is no tendency for them to be associated either with each other or with other offences. It would seem that murder and attempted murder are different types of crimes! Whatever the explanation, the fact remains that variations from year to year in these rates do not tend to move together. In practice, it might seem that attempted murder and felonious woundings may at times be difficult to separate in terms of the nature of the action. But again, over time, these crimes do not show similar patterns. The independence of the patterns of incidence of these three crimes may be surprising, but one thing is certain, if they are grouped together, then variations in one will obscure variations in the others. On the basis of this analysis it seems that separate indices are required for:

Murder
Attempted murder
Serious crimes against the person
Housebreaking, shopbreaking, robbery.

Although some assaults not classified as felonious or malicious wounding may be quite serious, the majority of cases taken under this classification do not involve the victim in any great degree of injury. It would appear that a sub-division of " violence against the person " is needed which would make the distinction between fights and social disturbances on the one hand, and the more serious attacks upon persons on the other. Perhaps assaults which are premeditated, assaults carried out on strangers, or assaults which do not take place within the same sub-culture, do not form a homogeneous category—they are perhaps basically different types of crimes.

The analysis of correlations which summarises the patterns of variations over time does not yield a simple explanation. Some of the results are not in accord with subjective impressions that one may have of the relationship between different types of crimes. Before any conclusions are based on these data, it seems desirable to examine some further evidence from other sources.

An Ecological Analysis

Human ecology, which is concerned with the relationship between humans and their environment, is a method of study which has attracted criminologists from time to time. Very early attempts can be found to connect the causation of crime with community and geographical characteristics. It is possible that interest in this approach began, as Vold suggests, with Tarde (1886), who put forward what he called a " law of imitation." This is more likely to be an accurate reference if it is legitimate to argue a relationship between the application of ecological methods to criminology and the theoretical explanation of crime in terms of " learned behaviour." On the other hand, the application of cartographic methods in criminology may be traced to Guerry (1833) in the first half of the nineteenth century. Mayhew (1851) reported that the general crime rate seemed to be higher than the average in industrial areas in

England and Wales. Other early work in this field was carried out by Quetelet. The majority of early studies in criminal ecology were based on the total crime rate, or selected types of crimes, and were directed towards the comparison of urban and rural criminality. This is, perhaps, not surprising, since at that time the population was sharply divided between urban and rural communities. Very many references could be traced to work of this kind, but those of Jones (1959) agree with the general pattern of evidence. He commented that, even in a small country like England with good means of communication, the differences in the pattern of community life are still very real and must have an effect " in causing differences in both the distribution and the form of criminal activity." In his study of Leicester Jones compared the city with the county for the years 1935, 1946 and 1954, and found that the general tendency was for higher crime rates in the more urbanised areas. His results also agreed with the general findings in that he noted that crimes against property were more characteristic of the town, while crimes against the person tended to be more characteristic of rural areas.

In almost all large towns and cities there are well-known districts in which crime and vice are supposed to be particularly prevalent. The study of delinquent areas in big cities has become a favoured field of many criminologists, particularly in the period 1930–40. Shaw and McKay (1942) studied juvenile delinquency in Chicago and concluded that the nature of delinquency varied in different areas, and that some areas showed little or no criminal activity. In general, a higher degree of criminality was found towards the centre of the city and in the surrounding industrial areas. These features tended to remain constant in that it was found that in those areas where criminality was high in 1930 the crime rate was similarly high in 1900, even although in the meantime the population and the nationality of the citizens had changed.

Perhaps the most sophisticated statistical analysis carried out to date utilising ecological methods is that of Calvin F. Schmid (1960) in his study of different districts of Seattle in 1957. Schmid was not concerned with the question of a crime index but with the relationships between crime and other social factors. He used the separate figures for each offence where there were sufficient numbers of cases in the category and omitted the remainder. Justifying this procedure he remarks: " Unlike most studies of crime and delinquency in which the entire gamut of violations is grouped into a single amorphous index, the various cases have been differentiated into relatively specific and precise categories." Nonetheless Schmid's correlation analysis based on geographic variations provides different information from that derived above using time as a base, but it may be studied from various points of view, including the problem of crime index construction. Unfortunately, Schmid's work relates to a different legal system and different types of crime classifications were used from those we were able to include in the analysis given in Table 2. One of the correlation analyses used by Schmid is reproduced as Table 3. In our own analysis we have been able to include only indictable offences, whereas Schmid, by making use of both " offences known to the police " and " arrests," was able to cover a wider range of criminal activity.

It will be seen that Schmid found that " bad " areas were generally bad, but bicycle thefts were *negatively* correlated with all other recorded crimes in his analysis except burglary (non-residence) and indecent exposure. This raises a general question of principle regarding the purposes of index construction. It may be that, as one type of crime goes up in one town or area, another goes up in a different area, whereas the incidence of the crimes examined may not be correlated or even inversely correlated. Thus, in comparing areas in terms of a general crime index, one is forced to equate many different and compensating factors. How many bicycle thefts and indecent exposures equal how many drunks or attempted suicides?

It must be emphasised that research work in one town, in one year, in one country, is not an adequate basis for generalisation. But Schmid's work helps to suggest ways in which the problem of a general index of crime might be approached. His work does throw some light on the time-based analysis for England and Wales given above. In Schmid's analysis, six offence groups were highly correlated with each other. They were:

Drunkenness and common drunkenness
Disorderly conduct (fighting or other)
Vagrancy
Lewdness (not indecent exposure)
Robbery—highway and car

TABLE 3

Intercorrelations of Crime Rates, Seattle, 1949–1951

VARIABLES X / Y			SUICIDE		DRUNKENNESS		DISORDERLY CONDUCT		VAGRANCY	SEX OFFENCES		LARCENY					FRAUD	BURGLARY			ROBBERY		
			Attempted	Completed	Drunk	Common drunk	Fighting	Other	Vagrancy	Lewdness	Indecent exposure	Petty larceny	Shop lifting	Bicycle theft	Auto theft	Theft from automobile	Cheque fraud	Residence-day	Residence-night	Non residence day & night	Highway and car	Non-residential	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	X/Y
SUICIDE	Attempted	1																					1
	Completed	2	600																				2
DRUNKENNESS	Drunk	3	652	·461																			3
	Common drunk	4	·491	·351	·975																		4
DISORDERLY CONDUCT	Fighting	5	·673	463	950	·908																	5
	Other	6	·634	·486	972	946	960																6
VAGRANCY	Vagrancy	7	·568	·398	·987	·990	·940	970															7
SEX OFFENCES	Lewdness	8	688	480	964	921	·964	·963	·949														8
	Indecent exposure	9	·185	046	$\overline{018}$	·$\overline{071}$	·$\overline{079}$	$\overline{024}$	·$\overline{050}$	·$\overline{057}$													9
LARCENY	Petty larceny	10	·668	·532	·971	·937	·936	·949	958	·951	$\overline{021}$												10
	Shop lifting	11	·713	462	·431	·305	·488	·474	·394	·481	·138	·437											11
	Bicycle theft	12	$\overline{192}$	·$\overline{271}$	·$\overline{194}$	·$\overline{157}$	·$\overline{183}$	·$\overline{211}$	·$\overline{163}$	·$\overline{219}$	314	·$\overline{189}$	·$\overline{038}$										12
	Auto theft	13	679	620	·415	273	430	·401	·324	·419	·271	·459	·546	·$\overline{127}$									13
	Theft from automobile	14	·890	·653	·758	·617	·759	·735	·682	·763	·168	·774	·688	·$\overline{175}$	·801								14
FRAUD	Cheque fraud	15	878	438	472	·301	·476	·435	·378	·505	·236	·490	·751	·$\overline{100}$	·698	·824							15
BURGLARY	Residence-day	16	890	398	·755	633	·760	720	·694	·775	·118	·744	·662	$\overline{144}$	·536	·852	·873						16
	Residence-night	17	·894	·394	628	·485	·656	598	·555	·671	127	·631	·680	·$\overline{129}$	·541	·820	·911	·964					17
	Non-residence day and night	18	$\overline{151}$	·$\overline{111}$	·$\overline{134}$	·$\overline{138}$	$\overline{053}$	·$\overline{080}$	·$\overline{115}$	·$\overline{132}$	·191	·$\overline{144}$	046	·263	·$\overline{036}$	·$\overline{068}$	·$\overline{139}$	·$\overline{110}$	·$\overline{099}$				18
ROBBERY	Highway & car	19	716	·502	962	·919	957	·960	·951	·954	·$\overline{018}$	·951	·540	·$\overline{175}$	487	·814	547	·801	·698	·$\overline{090}$			19
	Non-residential	20	·101	·189	·196	189	·286	264	·224	231	·$\overline{024}$	203	·145	$\overline{025}$	·032	·129	·$\overline{032}$	·095	·078	·364	·238		20
		Y/X	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	X/Y

Negative correlations indicated by sign (—) above figure.

The majority of these categories would not be included in " crimes known to the police " in English criminal statistics. The Seattle analysis also showed that burglary (residence day) and burglary (residence night) and cheque frauds are also closely related, but these groups are not so highly associated with each other as are the items in the group above, nor are they highly associated with the first group. Perhaps it would be meaningful to regard the first group of offences as providing an index of " social disturbance " rather than " crime," if it were not for the item " robbery—highway and car," or petty larceny or lewdness. A transfer of the item " robbery " from the first group to the group including burglary would not do violence to the Seattle data; thus, it seems reasonable to conclude (so far as the Seattle data go) that geographical patterns of offences suggest a crime index of three offence groups:

I. Burglary (residence day)
Burglary (residence night)
Robbery (highway and car)
Cheque frauds *A Crime Index*
II. Murder rate *Murder Index*
III. Drunkenness and common drunkenness
Disorderly conduct (fighting or other)
Vagrancy
Lewdness (not indecent exposure)
Petty larceny *Social Disorganisation Index*

According to the law of England and Wales, the first group approximates to housebreaking, shopbreaking and burglary. The crimes of cheque fraud and robbery (highway and car) are not grouped separately in the figures for England and Wales and there are very few cheque frauds.

It is obvious, and our data tend to support the argument, that a general crime index adding together serious and non-serious offences against property and persons does not meet the requirements of a good index. Utilising both the time-based and the geographic-based data, it would seem that four indices are desirable:

I. Serious crimes against property (*e.g.*, burglary, breaking and entry, robbery)
II. Social disorganisation (*e.g.*, drunkenness, disorderly conduct and petty larceny)
III. Serious crime against the person
IV. Homicide (a) murder
(b) manslaughter

Unfortunately the legal categories under which offences are classified for statistical purposes in this country frequently do not distinguish the degree of seriousness. For example, the value of the property stolen is not regarded as relevant to the charge of larceny. Robbery may consist of anything from a bank hold-up making national headlines to a small boy tripping up another and stealing his pocket money. The dividing line between serious and non-serious violence against the person is one which may well vary from time to time and from place to place according to the attitudes of the culture in which the event occurs.

Static and Dynamic Indices

Index numbers are very attractive, particularly to the research worker who has not been trained in statistical methods. Their attraction is a potential danger, in that they seem to simplify complex problems—but they only *seem* to simplify them. There are many dangers of interpretation even if index numbers are refined to the last degree possible. Clearly an event which is not perceived today as a serious crime cannot be included in an index of serious crime, but the same event may tomorrow be perceived by the society of that time in a different way. Society is dynamic, and the problem of the extent to which an index of crime should reflect the changing attitudes of the culture is a thorny problem. If events were to be defined in such a way that the classification of a crime indicated very precisely the nature of the action and the role of the actors in such a situation, some sort of fixed base index might be meaningful, but the purposes of social defence are doubtless best served by definitions which can be interpreted in slightly varying ways in order to take account of the changing attitudes of society without the necessity of revising completely the legal structure at very frequent intervals. Looked at in terms only of the nature of the action, the small boy who steals another's pocket money and the bank robber are behaving in an exactly similar way—they are both removing property from another with the use of force or threat of force. It is not the action which gives rise to different levels of social disapprobation, but the actors and the interpretation of the social significance of the action in terms of the culture of the society. A partial solution to this problem might be obtained by the use of two types of indices, one of which was fixed at some time base and the other dynamic—taking into account changes in the expected behaviour related to the social attitudes of the time.

It has to be confessed, however, that at the present time there is no satisfactory " crime index " and the greatest care must be taken in the interpretation of any crime rates or other similar figures. At present there are both static and dynamic elements in the criminal statistics, and it is not possible to separate these from each other.

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SOME PSYCHOLOGICAL ASPECTS OF ORAL EVIDENCE*

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ALTHOUGH some of our rules of evidence stem from Old Testament times, such as the concepts of corroboration and perjury, the English law of evidence is of comparatively recent development. When mediaeval trials were by ordeal or compurgation there was no need for evidence, and later, when the jury system was introduced, the juror was his own witness. Oral evidence as such therefore played no part in the procedure of English law until the role of afforcing juror had been discontinued, and it is only in the last two centuries that our present law of evidence has been formally developed. This has an important implication for our present discussion, for it means that this branch of English law is least rigid, and is therefore less resistant to social influences than other divisions of the legal system.

The purpose of introducing oral evidence is to acquaint the jury with the facts as perceived by the witness. Ideally, from this view, the juror becomes an afforcing juror, and the more successful the testimony, the more likely the jury will be to make judgments as if they had actually witnessed the event in question. Oral evidence, then, is the transmission of facts to the jury, and the examination in chief and cross-examination are not expected to alter these facts however much they may change the importance and value ascribed to them. This assumption of the immutability of facts has been seriously questioned by psychologists, and the purpose of this paper is to present a little of the evidence which has emerged from their experiments and investigations.

Analysis of Testimony

Interest in testimony as a psychological process has existed for at least half a century, for long before the first world war Professor

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Binet in France was already making the first preliminary inquiries into the mechanism of memory. Despite the passage of the ensuing years, however, psychologists have not been very successful in dealing with specific problems of court experience, chiefly because the latter must, of necessity, be kept free from extra-judicial interference. This has meant that any type of investigation must rely upon inference based on the similarity between the method adopted and actual court experiences, although the general laws of mental processes are such that this impediment is not of vital importance.

At present there are three main types of approach. First comes the laboratory experiment, for example, Bartlett's (1932) work on memory. Next Strodbeck's method in which a mock trial is held in a court setting: jurors are selected from an actual jury list, and actors portray the characters of a real trial using the verbatim court records. Thirdly comes the writer's method of recording court proceedings and then conducting standardised interviews with the jury and witnesses afterwards. Each method is complementary rather than competitive, yielding useful data which would not be obtainable by other methods. In addition, expert testimony is receiving some investigation and study by those participating in this role (*e.g.*, Haward, 1960, 1961a/b).

In order to consider in some detail the major findings relevant to this subject, it is convenient to separate the total process into its individual functions. There are three stages: first, the processes in the real world or the " act in question "; secondly, the mental processes of the witness, subdivided into perception, recall, and verbalisation; and finally, the reception of the testimony by the jury, which will include the perception of the same evidence from four different sources—namely, the original witness, the two counsel presenting the case, then the judge in summing up—together with the deliberations and conclusions or verdict. These various phases will now be considered in the order in which they naturally occur.

The Act Itself

Before inquiring into the validity and reliability of the evidence for any act, it is important to remember that our implied criterion is the act itself. We accept this as a scientific fact and then proceed to match the evidence against what we believe to be true. For purposes of expediency it is natural for us to take up a pragmatic position, but a majority consensus is no criterion of the truth of the matter in hand, and one man may be right though one thousand others honestly believe otherwise. While this is essentially an epistemological problem, which cannot be discussed here, it is necessary for us to realise that our original premises may be constructed on the shifting sands of human understanding. Unless we come to some sort of philosophical terms with the first problem we are ill-equipped to deal with the later ones.

Perception by the Witness

Before an eye-witness actually experiences the events taking place in the real world, the information received by his senses—the raw sense data—is acted upon by cerebral processes, which select, organise and transform the information according to the conditions existing in the witness at the time. These are the perceptual processes, a dynamic but orderly system whereby sense data are endowed with meaning. There is no passive recording of impressions, and every witness present at the time will experience the sequence of events in a somewhat different way. Because of his own psychological processes, the perceiver places a unique construction upon the world as he experiences it. Indeed, when such processes are under stress they lead to such distortions of the perceived field that they may become delusions or hallucinations. We see here an interplay between two perceptual mechanisms—a generalisation about the present in terms of the past and the organisation of sense data to fit into present needs—an interaction which occurs in an individual with a unique life-history, a particular *weltanschauung*, and a hierarchy of motivations. The perceiver thus creates his own perceptual world, and to the degree that the projective and integrative forces within him are unique, his world is like the world of no other person. Perception itself is too vast a subject to be discussed in this paper, but a few examples might serve to illustrate its relevance to testimony.

Social Attitudes

Our perceptions are coloured, to some exent, by our attitudes to other people present at the time. If their behaviour is relevant to us, as when an accomplice gives evidence, then their actual perceptions are coloured according to whether the perceiver stands to gain or lose by the perception. This is quite independent of the conscious bias that possibly exists in such cases, and the work of Jones and de Charns (1957) indicates that the well-known *presumptio hominis* concerning tainted evidence carries a deeper meaning than perhaps we realise. Related to this work is the experiment of Bieri (1953) which showed that what we think a person *did* depends in part upon whether he agrees with us or not. Of wider significance is the problem of ethnic stereotypes and racial prejudice. Following the early work of Katz and Braly (1935) social psychologists have built up an impressive accumulation of data which show how our perceptions are coloured by preconceived attitudes towards other races. Jews, Africans, Chinamen, Germans and many other races all mean something to the average witness before they are even considered as individuals. If he believes Germans are sadistic as a nation, or Jews are naturally dishonest, he is more likely actually to " see " sadism or cheating going on by these nationals. Most of us have ethnic stereotypes which originated with childhood stories, adult anecdotes, or wartime propaganda, and unless we have been able to modify these by acquiring more knowledge about such people, our perceptions will continue to be distorted. We may not all be as biased as the juror in a sexual offence case who said to the writer: " I knew he was guilty as soon as I learned he was French," but we cannot rule out misperceptions arising from such stereotypes. Furthermore, investigation shows that this holds for minority groups within our own culture. To the frustrated policeman the CND demonstrator's brief pause for rest may be seen as a calculated obstruction, while to the militant banner-waver the former's neutral gesture may be construed as an assault.

Expectancy

A general rule of perception is that we tend to see the things we expect to see. The psychologist calls this particular condition of expectancy " set," rather analogue to the athlete's warning " get set." Set may be either conscious or unconscious and in either condition it serves to facilitate the entry of certain stimuli and to inhibit the entry of others. When two competing stimuli occur, it is the one for which we are prepared that triggers off the perception or reaction. The effect of set can be so strong as to produce hallucinations, and Ellison (1941) produced hallucinations of sound in 80 per cent. of his subjects and Brown (1916) hallucinations of odour in 90 per cent. of his sample, merely by establishing a set. The social effects of set were well portrayed in a recent episode of ITV's " Coronation Street " where a lady, confronted by a man of dubious morals in a particular situation, and expecting an improper suggestion, actually perceived it. Her subsequent account of the episode led to behaviour which could well have ended in criminal proceedings. Such a situation often has a snowballing effect, particularly in domestic affairs, for an accusation based on misperception alerts processes in the partner which then lead to perceptual distortions on his own part. As communication becomes more formal between them, feedback is inadequate in modifying the increasing perceptual differences, and the rifts which the writer sees in his marriage guidance work can easily become the bases of petitions in the divorce courts. While the corroboration can often overcome such an important defect of evidence, this does not always follow, and many miscarriages of justice may have occurred as a result of this psychological process.

Emotional Pressures

Set is normally seen as a purely cognitive process, but moods also operate to produce a set. The anxious person expecting attack interprets an innocent gesture as assault, the fearstruck child passing a moonlit churchyard sees a ghost in the windblown paper, the depressed individual sees life as through a glass darkly. Murray (1933) found that anxious people interpret others as being more malicious than they would appear to them in a normal state and this in turn leads to distortions of perception. Murray's work has since been expanded by Leuba and Lucas (1945), who demonstrated by hypnotically induced states of fear, rage, anxiety and so on, that our perceptions are clearly influenced by these emotions. The emotions themselves need not be obvious, and Kelley (1950) has shown how our first impressions of other people vary according to their placement on an emotional warmth-coldness continuum. A well-known projective test uses pictures of socially ambiguous situations deliberately to produce perceptual distortions. In the clinical setting, the patient's perceptual processes provide information about his personality and diagnosis. In real life they may well lead to the conviction of an innocent person.

· Physiological Needs

The last of the major perceptual processes are those which arise not from psychological needs but from physical ones. Bruner and Goodman's (1942) classic work on values demonstrates that we see things with a size and intensity that vary according to their relative values to us as individuals. For example, poor children substantially over-estimate the size of coins compared with rich children, the over-estimation increasing with the value of the coin, but breaking down when the value is so large that it is unrealistic in the context of the poor child's world. Hungry men see blurred pictures mainly as tempting food dishes, whereas the same pictures are seen as pin-up girls by men isolated from female company for long periods. Again, these physiological needs do not have to be extreme to produce such perceptual differences: men do not have to be starving before they distort ambiguous pictures into portraits of food, for Sanford (1937) has shown that well-nourished people produce two and a half times more food responses before a regular meal than after it. How often important physiological drives, particularly sexual ones, have produced misperceptions which lead to offences —for example, a gesture misconstrued as an invitation leading to an unwanted suggestion—cannot be judged, but this certainly happens at a non-perceptual level, as in the case of the intellectually dull youth who saw the fruiterer's assistant hold up a banana and understood this to be an invitation to copulate, which he attempted to do there and then.

Professor Cole (1953) has given us probably the most comprehensive account of social perception to be published. He describes the perceiver as contaminated to the core with his social history, his participation in a culture, and his membership of family, class and clique. Thus embedded at birth in human relationships of a particular kind, the very machinery of thought and perception is socially conditioned and finally determined. More importantly, however, although his perceptions are socially derived and his truths depend upon consensual validation, he nevertheless views them as absolute truths, and any imputation to the contrary is an attack upon his personal integrity. We see this time and time again in cross-examination, where the witness, for this and other equally important reasons, will not admit to making a mistake. In considering perception thus, we arrive at a sociology of knowledge—an unconscious matrix of preperceptual forces within which the individual's conscious acts of perceiving arise. All our perceptions thus contain implicit assumptions, hidden premises, unconscious predilections, and arise from continuously changing motivations which are too deep for our awareness. In any situation the information from the senses falls not on a *tabula rasa* but on a dynamic matrix of sets—changing moods, stabilising habits, expectancies (conscious and unconscious) and consummations devoutly being wished.

Recall

Just as we learn that the experience of seeing and hearing is not a simple photographic or recording process, so too we find that memory is also a dynamic process. Forgetting is not passive but active. While organic factors of neural conductivity on which memory is based may produce decay, this has so far only been demonstrated in clinical conditions. In the normal healthy brain, memories appear to remain intact until removed or constrained by impressed forces. In deep natural sleep, for example, no forgetting takes place. In the waking state, however, or in light, uneasy sleep when the brain is active, cerebral functioning interferes with our memory traces and subsequent recall, producing a continuous deterioration of a particular group of memories. This illustrates the first mechanism of forgetting, which is called " retroactive inhibition." This term serves to remind us that current mental functioning has a retroactive effect upon the processes of memory, and explains the decay of memory as a function of time. It is significant that even in an experimental situation when trained observers are employed as subjects, retroactive inhibition prevents recall of more than a minute fraction of the original memory. Thus in Blackburn and Lindgren's (1957) experiment, only 8·4 per cent. of an important discussion was recalled two weeks later by a group of professional psychologists. Pertinent to our present interest is the experimental fact that the more closely the succeeding mentation relates to the original mental processes, the greater will be the retroactive inhibition. In Belbrin's (1957) experiment, the subjects sat in a waiting room facing a road safety poster. After two minutes they were taken in for interview, half the group being asked questions about the poster and the other half discussing something completely different. Later, all were shown a copy of the poster and asked if it was the same as the one in the waiting room. Of those who had not thought about it since leaving the waiting room 88 per cent. correctly identified the poster again. Of those who had discussed the poster between times, and had tried to recall the various details on it, only 25 per cent. correctly identified the poster. This means that, after an event which we have witnessed, any activity involving the memory of that event will actually reduce our chances of correctly recalling the details at a later date. Witnesses who have already recounted the incident to their family and friends, to a policeman and solicitor, are thus poorly placed to give an accurate account of the incident itself.

Another mechanism of forgetting is called repression. This is the unconscious blocking of recall by emotionally involved processes. Unlike retroactive inhibition, which is a natural process designed to clear the memory slate to make room for continuing experience, repression is a defence mechanism which comes into play only when our mind must be protected against a noxious experience. Thus only 30 per cent. of our first memories are unpleasant ones, and in an experiment where the subjects were asked to write out a list of words rapidly (to avoid conscious selection or classification) only eighty words of an unpleasant connotation were obtained compared with 1,057 pleasant words. Repression can be demonstrated quite simply in the laboratory by giving the subject a mild electric shock whenever the significant stimulus is presented. Anxiety or fear will then become attached to this stimulus and in recall only the non-significant stimuli will be remembered. Again, it should be pointed out that we are not merely talking about extremes, but about everyday processes, for Hovland (1957) has shown that any mild unpleasant aspect of the situation becomes less well remembered, insofar as it affects the onlooker personally. Obviously, the relative importance of the details will affect the probability of their being recalled, and Newman (1939) found 87 per cent. of essential details recalled after eight hours compared with only 23 non-essential details. Expectancy plays its part here, for on being shown a series of coloured dots, we remember either the colour or the number of dots, but not both (Kuelpe, 1904). That is, we remember only what we think we ought to remember.

So far we have considered only sins of omission, experimental work pointing to the conclusion that after the lapse of some weeks we recall little, in its pure uncontaminated form, of what we have perceived: yet everyday experience contradicts this finding, for most of us believe that we could give quite a creditable account of some event in the past, especially if it was one which was out of the ordinary. This is where our sins of commission creep in, for experiments show that little of what we recall is unchanged during the intervening period of time. Blackburn and Lindgren's subjects, for example, who recalled only 8 per cent. of the discussion two weeks later, gave 42 per cent. substantially incorrect accounts, while another investigator found only five errorless reports in 240 testimonies. Generally speaking, the errorless report is given only by extremely cautious witnesses who refuse to commit themselves whenever possible and who make relatively few statements. For the others, errors accumulate according to the number of questions asked and the time that has elapsed. So consistent is distortion of memory, in fact, that a majority statement is often less guarantee of its truth than a minority one, for consistent errors generally serve to reinforce the belief in their truth.

Experience has shown that the three things most liable to error are: the time of day at which an event took place, the spatial positions of the people present, and the number of objects concerned.

It is perhaps noteworthy that these are often central features in a criminal investigation. The processes of distortion are under way almost as soon as we commit something to memory, and no less than 7 per cent. of what we recall during the same day will be erroneous, even when we make deliberate efforts to retain accurate details of the event. By the end of the month, even the most experienced police officer will recall 20 per cent. false memories unless aided by notes made at the time. Most of what we have described about perception applies to the processes of memory. Obviously we can remember only what we perceive and not necessarily what actually took place. Emotions, set, social attitudes all play their part in stamping certain memories and obliterating others: Levine and Murphy (1943) found that we remember best those things which conveniently support our own social attitudes while innocently forgetting things which conflict with our original views. Festinger's (1952) work on crowd behaviour has shown that those most uninhibited in a crowd have the worst memory for what occurred, yet these are the very people who are most likely to be involved in criminal proceedings.

Perhaps the most discouraging aspect of these studies is the way professional psychologists, aware of these distorting processes and consciously trying to eliminate them, fail completely in any memory experiment to compensate for these deficiencies by the use of their knowledge. With all the confidence of the professional expert, they recount happenings that never happened at all, or which occurred at another time, or at another place, or to another person. This serves to emphasise what pawns our conscious wills are in the hands of unconscious processes. Bartlett (1932), whose work is still the leading text on the subject, shows very clearly how impotent we are to effect any changes in what he calls " assimilation into the schemata."

Memories, then, may bear little relationship to the events in the real world. Already distorted by perceptual processes, those residual memories that are not kept from consciousness by retroactive inhibition or repression have been transformed by unique intrapersonal processes that leave little of them unchanged. Like percepts, we index our memories according to previous experience, infusing them with personal meaning. Unwittingly, our remembering takes on a constructive and inventive character and becomes dogmatic, assertive and confident.

Verbalisation

Perceiving and recalling are not yet enough; the witness must still communicate the content of these processes to the court. Insofar as we are concerned with truth, then the best way to receive this information is by a report made spontaneously at the time of the event. Such a report will contain few errors but many omissions—an average of 10 per cent. errors has been recorded. A deposition made by answering questions produces less omissions but more errors, which now rise to an average of 25 per cent. even without leading questions. Hunter describes six types of questions which may be put to the witness, four of which carry implications leading to false answers. Stern (1924) has shown that young persons eighteen years of age will unwittingly give false answers to no fewer than 20 per cent. leading questions. The degree of error quoted in these preceding cases is for immediate recall; if we add time as a variable our proportion of erroneous testimony increases continuously as a function of time. The level of unreliability is already sufficient to give us pause to think, but once the witness is in the box a new set of conditions come into operation to distort the testimony still further.

Many investigators (*e.g.*, Argyle, 1957) have illustrated that the effect of an audience is to slow down the mental and physical performance of an individual, causing him to make more mistakes. If emotions are aroused more mistakes will occur, and it is rare for a witness to be emotionally undisturbed when in the witness-box. Furthermore, the type of emotion aroused produces different types of distortion. Fear, embarrassment, annoyance all provide a slightly different version of the original percept, and these processes may be augmented by the attitude of the inquisitor. Weiss and Fire (1956), for example, found that if the questioner was insulting and so aroused aggressive and hostile feelings within the witness, the memories of the witness tended to contain more aggressive ideas and primitive concepts than they did in a neutral situation: thus, he was more likely to say " struck " than " touch," and by the unconscious choice of predominantly aggressive adjectives and verbs build up a completely false picture of an event. The cold detached scientific manner is sometimes no better, for Lord (1950) shows that a cold manner produces many more mistakes than a warm one. An important feature of court procedure is that the witnesses should be isolated from each other to avoid collusion, yet insofar as we are dealing with honest witnesses we are less likely to arrive at the truth than if we allowed them to meet for discussion first. Muensterberg (1914) and Allport (1920) have conducted experiments which show that our own judgment improves as judgments by others become available. The opinions and statements of other people provide an extrapersonal context in which our own performance can be re-assessed, and as much as 50 per cent. improvement has been obtained by exposing the experimental subject to others similarly placed. The problem is not a straightforward one, however, and the dangers of mixing witnesses of doubtful integrity are manifest. Another profound effect of the audience upon the witness depends upon whether the latter conceives the audience as being hostile or friendly. A favourable audience improves recall, but Zimmerman and Bauer (1956) found that a hostile audience reduces the efficiency of recall by about 50 per cent.

Effects of Testimony upon the Jury

Just as events in the real world are distorted by the perceptual and memory processes of the witness, so the testimony of the latter is similarly transformed by the jury. Here the situation is a little different, however, in that we have a group process operating rather than an individual one, and we have already mentioned one advantage of group discussion in formulating judgments. While we may expect many of the factors which produce distortion in individual processes to be mutually compensating, some of them turn out to be additive or accumulative by group reinforcement, so that in some cases the group perception is more distorted than the individual one.

The manner and appearance of the witness will determine in part the attitude of the jury towards his testimony. Thornton (1940) found that a smile created a favourable impression which made testimony more acceptable, while an unsmiling witness created suspicion. He also found that estimates of intelligence related to the wearing of glasses, so that a smiling bespectacled witness's testimony will be likely to carry an unfair weight compared with a witness of different appearance. This leads us to consider the so-called "halo effect." If once a witness has made a favourable impression on one point we tend to over-estimate his worth on all other points. Brunswick found that although intelligence and energy correlate only 0·28 on tests, they correlate 0·84 on judgments, that is, having once decided that the subject was intelligent the judges tended to endow him with a higher degree of other positive attributes than he really possessed. Despite our confidence in judging issues, experiments show that individual differences between judges (in the non-legal sense) are so great that judgments are usually quite invalid. Vernon (1933) found judgments on one issue ranging from 17 per cent. to 98 per cent., while in placing candidates in order of merit on some variable, it not infrequently happens that one man comes top of the list by one judge and bottom by another. Prejudice, too, plays an important part in the jury's reception of evidence, for although Allport and Kramer (1946) found that we identify more accurately a person of a disliked race than one from another neutral race (and this is a not unimportant factor in identity parades). Scodel and Mussen (1953) have since shown that in such a situation perceptual inaccuracies are more common. Projection, too, enters into this process, so that if the receiver possesses undesirable traits, such as meanness, dishonesty, etc., he tends to overrate them in other people (Sears, 1936).

Since the war, particular attention has been centred upon the order in which arguments are presented to the jury. Horland's (1957) work is pertinent to this area of discussion. He found that in general the last version of the case carries more weight than the first version although the difference is usually small. It is most noticeable when cognitive needs are weak, that is, when the jury is bored, disinterested or overwhelmed by the quantity of evidence. In long trials, therefore, or those with a minimum content of human interest, the final presentation of the case will make a relatively greater impact upon the jury than the first one. In one particular situation the effects of primacy are paramount. This is where the juror commits himself to one view before hearing the other side. Once public commitment is made, for example, over lunch in the juryroom, the juror's views become resistant to influence by the second side of the issue, and it is then difficult to produce a reversal of position by presentation of the opposite argument. If the particular juror has undue influence in the jury deliberations, as will be discussed later, then premature commitment may well result in a reversal of verdict from what would otherwise have been given. When contradictory information is presented by one witness, Horland found that a tendency arises to accept the earlier version in preference to later ones. With a poor witness, therefore, cross-examination becomes less effective in clarifying the issue, and the original statement, however erroneous, is likely to be accepted at its face value. Information which satisfies needs also receives greater acceptance, particularly if the needs are aroused in court by counsel, so that a successful evocation of sympathy requiring avoidance of punishment for the offender will lead to acceptance of mitigating circumstances or of medical evidence of diminished responsibility.

In the summing up and recapitulation of oral evidence the pros are more acceptable than the cons when presented first. There is a factor of suggestibility here operating in an approach-avoidance situation. When the judge considers the pros, the interpersonal distance between himself and the jury is lessened (psychologically speaking) and this by itself may induce the jury to agree with him. Having been drawn closer, it is then less easy for them to separate in discussing the cons. In putting the cons first the reverse is the case. Many judicial summaries carry implicit suggestions for acceptance or rejection, depending in part upon the wording used, the order of presentation, the attitude of the judge, and the use of constructive or destructive methods of criticism. All these and many other factors will add or reduce the weighted importance of the testimony before even the deliberations begin.

The Jury Deliberations

The work of Strodbeck (1959) has been particularly concerned with the effects of social status upon jury conclusions. Data from ninety-one jury sessions has pinpointed the election of the foreman as the first major factor in this process. In half the cases the foreman is nominated almost immediately by one member and quickly accepted by the group, and in one-third of the cases the person who opened the discussion or focused the group's attention on the responsibility for selecting a foreman was himself elected to that office. Four times as many professional as manual workers become foremen, while only one-fifth of the women predicted by proportional representation are actually elected. The leadership role is an important one: the foreman provides an average of no less than 25 per cent. of all the conversation during deliberation, and since judgments tend to follow the norm provided by any person with prestige (Leavitt, 1951) it is found that the jury tend to modify their own opinions according to those of the foreman. An interesting feature of role-playing by the foreman is that the position tends to influence his own ideas, for Janis and King (1954) found that by putting the case over to the jury the foreman's own ideas are modified. Lewin (1959) found that group decisions are more influenced by the group leader—in this case the foreman—than by extra-group communications, for example, from judge or counsel, although the perceived status of the communicant is not an unimportant factor. During the discussions, the position of each juror within the group will determine the form and length of the discussion. Group cohesiveness reduces the time required to reach a conclusion, both by eliminating redundant information and by influencing the minority to change their position (Back, 1951). Although some individuals will maintain their independence throughout the discussion, a substantial minority will yield to the majority's viewpoint. The size of the majority and the degree of definition in the issue determines how long this takes, but this type of independence is a personality correlate and in some cases will never be made to conform to the remainder of the group (Guetzkow, 1951; Barron, 1952). Those who yielded to majority opinions tend to have a perceptual preference for simplicity and will agree with a solution even if it is seems obviously wrong. Bass (1950) and Rosenthal and Cafer (1948) in another context have examined the effect of indifferent, disinterested or negative attitudes in group discussions. They find that one man can prevent agreement among others and reduce the belief in the attainability of group goals—a characteristic all too common in summit conferences.

The relative status of the jurors, as well as their personalities, determines their position within the group. According to whether they operate in the centre or the periphery of the discussion depends their participation, behaviour and judgment. As Leavitt (1951) shows, the meek refrain from voicing their opinions if their perceived status is low. Socio-economic level also determines degree of participation. The professional classes not unexpectedly take first place in terms of higher participation, influence, satisfaction and perceived competence, with unskilled workers in last place. Deliberations prove most efficient when the jury are of relatively equal status, and several investigators, such as Staton (1948) and Swanson (1951), have demonstrated how too wide a range of status within one group prevents adequate cohesion and significantly lowers efficiency.

Agreement is finally reached by the conversion or yielding of the minority (even if they really disagree) and the reinforcement of the opinions of the majority by a conditioning process. That is, we tend to repeat or paraphrase opinions if generally accepted, but gradually reduce and finally eliminate them if rejected or criticised (Verplanck, 1956). By this time, the details of the testimony debated by the jury may bear little resemblance to the original act in question, while the value placed on this evidence has little, if any, relation with that decided on objective logical grounds.

Discussion

Thus we see oral evidence, not as the transmission of information from witness to jury, but as a fluid process of great complexity in which the characteristics of events in the real world undergo various and sometimes extensive changes before they determine the jury's verdict. The original sense data are distorted by perceptual and memory processes in the dynamic matrix of the witness's mind, transformed still further during testimony under the influence of personal and social factors produced by court-room procedure, modified by repetition and deliberate rephrasing by the counsel for each side and the judge in summing up, and finally altered by perceptual and memory processes of the jurors, and by the social factors obtaining during the deliberations. During this process, the personalities of the behaver in the real world, of the witness, counsel and judge, and finally of the foreman and fellow jurors have played a not inconsiderable part in determining the direction, quality and degree of these changes. In some cases the end product of testimony may be either worthless or dangerously misleading.

Can we be satisfied with this state of affairs, and, if not, can we do anything to improve it? To do so would mean changes in the collection and presentation of evidence, in court procedure, and possibly in the jury system itself. Since *Chapman's* case of 1946, when a jury was directed to ignore unequivocal scientific evidence in favour of " common sense," there has been increasing dissatisfaction amongst scientists concerning the subjugation of expert evidence. While the time is not yet ripe for the computor to replace the man on the Clapham omnibus, a century of psychological investigation has provided sufficient evidence to destroy any belief we might hold that our convictions are infallible. The rival claims of mass interest versus expert knowledge have been discussed since the days of classical Greece: the Republic of Plato and the Brave New World of Huxley differ in their philosophical bases but not in their creator's insistence that where efficiency has a moral or expedient value an oligarchal development must inevitably ensue. Truth serves the interests of justice, but the truth of science and the truth of common experience and understanding are seldom the same thing. Whether we take any practical steps to improve the accuracy of testimony will depend upon whether we take up an absolute or a pragmatic point of view, and so our own deliberations return in full circle to a philosophical problem. Yet we ourselves are creatures of our own social circumstances, and whatever we may decide may well have been determined long ago in our own ontogenetic history.

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POLICE JUVENILE LIAISON SCHEMES

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SUCH information as is generally available about juvenile liaison schemes is limited to the reports of the pioneer Liverpool scheme and to the short section on the subject in the Ingleby Report.[1] The present paper discusses some general comments on juvenile liaison and reports some findings from a study of the scheme as it operates in Greenock, the first of the six Scottish police areas which have so far tried it out.[2]

An informal survey made last year found that, since the Liverpool (pilot) Scheme was started in 1949, the following police districts in England and Wales have followed suit: Leeds, Huddersfield, Birmingham, Bristol, Birkenhead, Bradford, South Shields, Blackpool, West Ham, Manchester, Halifax and Cardiff; while schemes started in Carlisle and Dudley appear to have been discontinued. We understand that the Carlisle scheme may be resumed after an interval, and that a new scheme has been started very recently in part of Lancashire. In Scotland the pioneer scheme was that of Greenock, started in 1956, and since then Coatbridge, Perth, Kilmarnock, Paisley and the counties of Stirling and Clackmannan police districts have got going. Perhaps Birmingham and West Ham are too distinctively different from the others to qualify for inclusion in this list. In the Birmingham Juvenile Scheme, as it is called, the period of supervision lasts for four months only with few exceptions and the work is carried out by officers appointed by the superintendent in each division in conjunction with their ordinary police duties. In West Ham, in the Metropolitan Police District, the Modified

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[1] Report of the Committee on Children and Young Persons (H.M.S.O. London 1960). Paragraphs 138–149.

[2] This Greenock study was financially assisted by the Scottish Home and Health Dept. Miss M. Ritchie of this department was responsible for the field work and the checking of statistics.

Juvenile Liaison Scheme, as it is called, was initiated as a result of a special request from the chief education officer of the borough and has continued as a police service of home visitation in response to requests from parents and headmasters. It has no connection with any system of oral cautioning of juvenile offenders, for none exists in the Metropolitan District. All of the other schemes, although they vary somewhat in their detailed methods of operation, work broadly on the lines first attempted in Liverpool. They are, in essence, a development and following up of the already established practice of oral police cautioning of minor delinquents. In the words of the Ingleby Report: " When a young offender is cautioned, a police officer follows up the caution by keeping in touch with him and enlisting the co-operation of his family, his school, and if need be, the statutory and voluntary social services in preventing him from offending again " (para. 139).

The Liverpool Scheme

The latest report of the Liverpool Scheme—*The Police and Children*, 1962 edition—fills out this brief description. It records that the scheme was established on a firm basis, after a year or two of pilot experiment, in 1952, when it was incorporated in the Crime Prevention Branch of the Liverpool City Police. It is now staffed by two sergeants and seventeen constables (including four policewomen) under the supervision of a chief inspector. The selection of these officers, says the report, is made from personnel who have applied for the work, and who are suitably qualified by aptitude and experience of youth work. One main feature of the Liverpool scheme is the great emphasis placed on liaison with all who are concerned with the welfare of children—particularly head teachers, ministers of religion and youth club leaders; and this is underlined in the Report by contributions from a local deputy headmaster and ex-President of the National Association of Schoolmasters, Mr. A. L. Jones, and from the Warden of Liverpool University Settlement, Mr. Raymond Clarke. Further and impressive evidence that the scheme has found favour in the eyes of other social agencies and in particular of parents and elders is given by a table showing the changing composition of entrants into the scheme. There are two broad categories: those children who have committed an offence and who have not previously come to the notice of the police, and secondly, those children who are not known to have committed any offence but are brought to the notice of the juvenile liaison officers by their parents, teachers, or by other police officers, for playing truant, being unruly, staying out late at night, and so on. These are described as "potential delinquents." The proportion of those dealt with as first offenders, coming into the scheme by the normal police channels and after cautioning, has fallen year by year from 93 per cent. in 1952 to 58 per cent. in 1960; and the proportion of "potential delinquents" has correspondingly risen from 7 per cent. to 42 per cent. Thus the number of "potential delinquents" in 1960 was 343 out of a total entry of 818.

A useful statistical appendix reports the proportion of "failures"—those who commit a further offence for which they are brought to court and found guilty. Further reference to this is made below.

Non-Police Juvenile Liaison Schemes

This kind of work is, of course, not new, nor is it a distinctively police interest. Probation officers are often asked to concern themselves with petty offendings which do not seem to the people concerned to warrant a court appearance. Parents, schoolmasters, police and others may call the probation officer's attention to such cases and he will spend as much time as he can spare in advising them or talking to the youngsters. In one Scottish county, in the period 1936–53, the principal probation officer did a great deal of the work of this kind in co-operation with the police and the procurator-fiscal (public prosecutor); roughly about half his work was unreported, since it was conducted on what might be called the "sub-court" level. In another Scottish probation area the probation service has dealt regularly since 1936 with a small proportion of "sub-court" cases, some of which are a follow-up of police cautioning and others on which they are consulted by parents. But the load of official supervisory and other work laid on the probation service by the courts has been so heavy over the whole post-war period that these remain exceptional cases in

Scotland. There are probably analogous developments in England and Wales, but we have no record of them.

The police have always used informal and non-court methods of dealing with very minor offenders. This is true to this day in the country districts, as was pointed out to the Ingleby Committee. The country policeman is known to his neighbours and the people over his whole district. He gets the help of parents and others in keeping youngsters out of further trouble without bringing them to court and without the semi-formal procedure of cautioning. The Juvenile Liaison Schemes now operating in Liverpool and elsewhere might be regarded as an attempt to reproduce in the more congested and anonymous conditions of the urban area a liaison which operates without formal contrivance in the village.

The deliberate organisation of any such liaison by city and town police forces is, of course, open to criticism. The beginnings of the probation service, and particularly the attempts in Birmingham and Glasgow in the early 1900's which anticipated the statutory scheme, were doubtless attended by the same criticism. But this new police initiative comes at a time when the procedures adopted for dealing with young offenders are strongly established and have worked out clear principles of operation; and in the light of these principles, the police juvenile liaison schemes are open to two criticisms. The first is that these activities are an illegitimate extension of police duties. This was well put by a senior probation officer in a discussion held in London in 1959. " It would appear," he said, " that the police in the scheme are setting themselves up as prosecutor, judge and executor of the sentence imposed. Is not this to remove from the offender all the protection and rights afforded by the courts of justice? " The obvious comment on this is that liaison work is an extension of police cautioning and police cautions are given only in cases where the offence is admitted. There is, of course, a possibility of intimidation, but the remedy for this is not necessarily that every petty offence be brought to court.

The second criticism, quoted by the Ingleby Committee, is that the police officers operating these schemes do not have the qualifications or training required to deal with young offenders; the juvenile court and the probation service are staffed by people who are suitably qualified; it is therefore unfair to the petty offenders to deprive them of the opportunity of being given adequate attention and treatment by withdrawing them from the attention of the courts as the liaison schemes do. This is a powerful criticism, but it is a criticism not of juvenile liaison as such, but of the practice of entrusting the work of home visiting and similar activities to unqualified and untrained workers. It does not necessarily follow that the police officers detailed for the work do in fact lack the personal qualities required for it nor that it would be impossible or unwise to provide them with training. If these schemes were to prosper, some such development would probably follow. Alternatively, juvenile liaison might provide an opportunity for fruitful co-operation between police and probation officers, the latter taking over all or part of the supervisory side of juvenile liaison at the " sub-court " level. This has already happened in at least two Scottish areas, as was noted above. But the main question raised by this police initiative has not been touched on so far by the critics of juvenile liaison. It is whether the work in itself is meeting a real need. Is it filling a gap in the existing system? To answer this question requires a closer look at the juvenile court.

The Gap in the System

It is a truism that the development of the juvenile court since 1908 has produced a great increase in *recorded* juvenile delinquency. Previous to 1908 the police were most reluctant to take young petty offenders to court because of the danger of contamination, and because the ordinary court was highly unsuitable for children. The setting up of a court sympathetic to children and especially qualified to deal with them has so changed the attitude of police, parents, and public that nowadays a great many children are brought to court who were formerly dismissed with an entirely unofficial warning. This is generally agreed. Another consequence of the change is not so generally accepted. It is that many very petty offenders who now appear in court are almost too insignificant to deserve or benefit by it and take up time which might be better spent in giving a more adequate hearing to more serious cases. This is one of the findings of Dr. M. Grünhut's study of the juvenile court.[3] He draws attention to the large proportion of child and young offenders given an absolute or conditional discharge in England and Wales (corresponding disposals in Scotland are admonition and absolute discharge). In recent years, the proportion of offenders of under fourteen years of age given an absolute or conditional discharge in England and Wales has been just under 40 per cent. In Scotland the proportion of offenders under seventeen years of age dealt with by absolute discharge or admonition has been 35 per cent. in recent years. The figures relate to " indictable offences " in England and Wales and to " crimes " in Scotland. The proportion of sentences of maximum leniency on children and young persons committing " non-indictable offences " (" offences " in Scotland) is much higher.

Dr. Grünhut points the moral of these figures. " In some cases," he points out, " a discharge by the court is the prelude to a process of ' informal adjustment ' by appropriate arrangements voluntarily accepted by the parents. In other cases the magistrates deliberately refrain from any positive action *as a matter of treatment policy.* But in many or indeed most cases of absolute or conditional discharge—in practice there is little difference between the two—the magistrates are simply getting rid of trifling cases not suitable to be dealt with before a court of law. And this tends to weaken the court and, possibly, to accustom the young law-breaker gradually to the not too unpleasant experience of a court appearance " (p. 70). Dr. Grünhut suggests that this raises the major question whether the juvenile court should maintain its exclusive jurisdiction over every case of juvenile misbehaviour, or whether a sifting machinery should be established to keep certain cases out of court and to provide alternative methods of handling juvenile waywardness and petty delinquency. " A reform on these lines would assign to the courts those cases where a judicial decision is expected and required, but would spare from appearance in court many of those against whom at present the court itself thinks best to take no action at all " (p. 128).

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[3] *Juvenile Offenders before the Courts* (Oxford University Press 1956).

Juvenile Liaison as a Sifting Mechanism

The main finding of our Greenock study is that the juvenile liaison scheme in that town is already operating as a fairly effective sifting mechanism.

Greenock is a town of 76,000 population with a force of 156 police. The scheme is operated by a detective-inspector, a sergeant, and a woman police constable, who carry out their interviews and visits in plain clothes. The scheme was introduced in May 1956 as part of a wider project of crime and delinquency prevention, which included not only the normal activities recommended in the Home Office report on crime prevention, but also a close co-operation with other local government departments in rehabilitating decaying inter-war-built housing areas. The scheme also goes hand in hand with a strong police interest in developing clubs and recreational provision in the new housing areas of the town.[4] In the following analysis, however, we are concerned exclusively with the specific liaison work outlined by the Ingleby Committee, namely the following up of cases selected from the larger group of young offenders who are given a police caution, and also of other "potential" offenders referred by parents and non-police agencies, including children of less than eight years of age.

The first and lasting effect of the Greenock scheme, statistically considered, is that it has appreciably lightened the burden on the juvenile court.[5] In the four years before the introduction of the scheme (1952–55 inclusive) threequarters of the children known to have committed offences in Greenock—517 out of a total of 678 on an annual average—were brought before the juvenile court: the remainder were dealt with by police warning. (This is the term used in most Scottish police districts for what is elsewhere called police cautioning.) In the four years beginning with the first year of the scheme (1956–59 inclusive) just on half the children found to be committing offences in Greenock—265 out of a total of 518 on an annual average—appeared before the juvenile court: the remainder were dealt with by police warnings and by J.L.O. procedure in roughly equal proportions. The total figures just quoted show a considerable fall in the annual averages before and after 1956, from 678 to 518. This does not appear to be a direct result of the J.L.O. scheme. It is the outcome of other initiatives in crime prevention and of more general social factors operating over the whole of that part of Renfrewshire. But the net result of the double reducing process has been to cut down the annual average of juvenile court appearances from 517 to 265.

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[4] The other police juvenile liaison schemes are linked with similar broadly preventive activities.

[5] Greenock is a large burgh in Renfrewshire, one of the four Scottish areas (the others are Ayrshire, Fife and the City of Aberdeen) to opt in 1938 for the English-type "Justice of the Peace" Juvenile Court, known in Scotland as the "Section 50" Juvenile Court (s. 50 of the Children's Act (Scotland), 1937). No other Scottish police districts have operated s. 50 of the Act, so that the remaining twenty-six districts have Burgh Juvenile Courts and Sheriff Juvenile Courts. There are no comparative statistical grounds for holding that the Section 50 Juvenile Courts are better or worse administered than the others. It might, however, be argued that these four areas are more experimental-minded than the other twenty-six in matters affecting the juvenile court. The two Scottish areas which have tried out sub-court disposals as mentioned above are the County of Fife (where the scheme is now discontinued) and the City of Aberdeen; Ayrshire has developed some equally distinctive procedures.

The Changing Pattern of Court Disposals

A comparison of court disposals before and after 1956 shows that the cases sifted out by the J.L.O. mechanism are, as might be expected, the more light-weight types. The two years 1954 and 1955 yielded a total of 974 charges of crimes and offences of which 509 or 52 per cent. were dealt with by admonition (331), absolute discharge (110) or proceedings dropped (68). In the two years after 1956 (1957 and 1958) out of a total of 560 court appearances 222 or 40 per cent. were dealt with in one or other of these three ways. The proportion fined was 29 per cent. in 1954–55 and 33 per cent. in 1957–58. The proportion put on probation rose from 13 per cent. in 1954–55 to 20 per cent. in 1957–58. This greater use of probation comes out more clearly if we restrict ourselves to crimes only, for probation is seldom used for offences in the Greenock Juvenile Court. In 1954–55 the court made a probation order in 120 out of a total of 460 criminal charges or 26 per cent. In 1957–58 probation orders were made in 105 cases out of a total of 271 criminal charges or 40 per cent. These findings are reinforced still further if we confine our attention to *first offenders* appearing before the courts on criminal charges in those years. The main impact of the juvenile liaison system is, of course, on the total of first offenders. In 1954–55 the proportion of first offenders released (admonition, absolute discharge, proceedings dropped, etc.) was 65 per cent. In 1957–58 it was 47 per cent. The proportion fined fell from 13 per cent. to 1 per cent. The proportion put on probation rose from 21 per cent. to 47 per cent.—36 out of a total of 171 in 1954–55 to 46 out of a total of 98 in 1957–58. The two main conclusions to be drawn from the changing pattern of court disposals are: (1) that the juvenile court is dealing with a smaller number of more weighty offences, and (2) that the status of probation, measured by the increasing use made of probation by the court, has markedly improved in the years following the introduction of the J.L.O. scheme.

The Boy-Girl Ratio

The ratio of boys to girls taken into the scheme is 4½ : 1 over the period 1956–60. In the first year (or half-year May–December 1956) the ratio corresponds to the usual juvenile court ratio of 13 : 1 in Scotland and 12 : 1 in England and Wales. In the following year, as the scheme gets into its stride, it comes down to about four boys to one girl. In Liverpool, in the three years 1954–55–56, the combined totals are 1,987 boys to 459 girls or about 4¼ : 1. This is the same ratio as obtains in the leading American juvenile courts—which are Chancery not criminal courts—and in such comprehensive receiving centres as Stamford House Remand Centre in London. In this country it happens that roughly two out of three girls in trouble enough to enlist the attention of the public authority are dealt with not by court procedure but by some social or moral welfare agency. The Greenock (and Liverpool) J.L.O. figures are therefore what one would expect from a properly functioning preventive agency. It is a matter of interest that the more traditional method of police warning dealt in Greenock in 1956–60 inclusive with 683 boys as against only 33 girls—a ratio of 21 : 1.

Age Groups

The J.L.O. scheme in Greenock concentrates on the 8–14s with the accent on the 8–11 inclusive age bracket.

Thus the J.L.O. age group distribution in the period 1956–60 compared with the Greenock Juvenile Court distribution as follows (the comparison is made for boys only owing to the different proportion of boys and girls in the two systems; and for court first offenders only):

BOYS

	8–11	12–14	15–16
	%	%	%
Greenock J.L.O.	59	35	6
Greenock Juvenile Court (first offenders)	38	41	21

But the J.L.O. scheme does not seem to have winkled out a high proportion of younger offenders from the juvenile court lists. Figures for the 2½ year periods before and after May 1956 (the month of the introduction of the J.L.O. scheme) show that the proportion of 8–11s actually increased.

BOYS

		8–11	12–14	15–16	Total
Greenock Juvenile Court	No.	179	205	106	490
January 1954–May 1956	%	36	42	22	100
Greenock Juvenile Court	No.	110	104	57	271
May 1956–December 1958	%	41	38	21	100

Types of Offence

A sample of every tenth case allotted to juvenile liaison over the two years ending in December 1960 shows that, out of the twenty-nine cases in the sample, nineteen involved theft, six malicious mischief, two truancy, and two running away from home. The nineteen thefts included six cases of minor shoplifting, ten thefts from gardens or thefts of small quantities of coal or wood, and only one financially serious case—the theft of £12 from a friend's house, £8 of which had been returned by post. In 1957, thirteen J.L.O. cases were listed as housebreakings out of a total of 128. But all of them were very trifling cases, and in ten of the thirteen nothing was taken. On the whole the Greenock J.L.O. scheme cannot be faulted for taking on anything which ought prima facie to go to court, judged by the criterion of degree of seriousness of offence.

How Accurate is the Sifting Mechanism?

The main case in principle against all forms of non-court or sub-court "treatment" or disposal—the main case for bringing to court all child offenders, however insignificant—is that a very few children who may appear to be very petty delinquents are in reality potentially serious cases requiring special attention of the kind that only the court can provide. In practice there is always discrimination—the prosecutor, or the chief constable, or the clerk of the court, or some other court official, decides which cases the court should take and which are too trivial. It would be impracticable to flood the courts because one or two in a hundred might be potentially serious delinquents. But whatever method of sifting is used must be judged on its capacity to discriminate between the casual petty offender and the crucial pre-delinquent.

A fair practical test of the Greenock scheme in this respect is the careful and accurate record of "repeaters" kept by the Greenock Juvenile Liaison Officer. By "repeater" we mean a boy or girl within the J.L.O. scheme who commits a further offence and as a result is brought to court, thereby going out of the J.L.O. scheme. A cumulative comparison of the entrants and repeaters year by year shows that of the 596 children who came into the scheme between May 1956 and the end of 1960, 119 have committed a new offence and been brought to court at least once, a proportion of 20 per cent.

But this is a very rough index. It takes in all the entrants from the beginning of the scheme to date; those who have had nearly five years in which to offend again and those who have had only one or two months. It is much more accurate to take each year's entry and follow it up for successively longer periods. The following table shows the percentage of "non-repeaters" or "successes" for J.L.O. and for other forms of disposal of first offenders over periods of one to five years.

One would expect the J.L.O. group to have a higher "non-repeater" rates than the juvenile court groups, since the children taken to court are judged to present more serious problems; and to have a lower "non-repeater" rate than police warnings, since the children given warnings only are judged to present less serious problems. This is in fact what has happened. It is a fair indication that the J.L.O. allocation system is at least working within such limits of accuracy as can be determined on simple statistical grounds.

TABLE II

Greenock J.L.O. cases compared with other groups of first offenders as regards proportion of non-repeaters,[6] at end of—

	Yr. of entry %	2nd yr. %	3rd yr. %	4th yr. %	5th yr. %
Greenock Police Warnings Annual Averages—1956–58	94	85	78	72	70
Greenock J.L.O. Annual Averages 1956–60	94	84	76	72	67
Glasgow Juvenile Court First Offenders—1946	85	76	69	64	60
Greenock Juvenile Court First Offenders—1954	89	74	67	62	55

The Liverpool data on "failures" (or "repeaters" as we call them) in the report already described can be presented in a roughly comparable form to that of Table II. Broadly speaking the proportion of "non-repeaters" in the Liverpool scheme runs year after year at a level of 97 per cent. at the end of the year of entry, falls to 91 per cent. at the end of the second year, and to 89 per cent. at the end of the third year. These figures compare with 94 per cent., 84 per cent. and 76 per cent. in the Greenock J.L.O. scheme; that is to say, the failure rate goes up much more steeply in Greenock. This may be a result of long-standing regional differences in police recording methods or even in juvenile behaviour. The West of Scotland urban areas have for many years recorded a consistently higher juvenile crime rate than have the big English cities. It is probably wisest not to attempt statistical cross-comparisons between English and Scottish police districts.

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[6] The Glasgow study was made in 1954 by the then head of Glasgow C.I.D., Chief Superintendent McIlwrick; the checking of Greenock Juvenile Court and police warnings reconvictions was made by Miss Ritchie and Mrs. Graham of this department in 1960–61. Both checks were made by a detailed reference to criminal records in Glasgow and Greenock respectively. A similar check was made on the Greenock J.L.O. Lists.

Uncertainty about Supervision

The foregoing analysis has established at least tentatively that those police districts which have established J.L.O. schemes have by the same token set up something like the sifting mechanism asked for by Dr. Grünhut. They have also supplied what Dr. Grünhut omitted to discuss, except by implication, namely a positive alternative to the trivial and nugatory disposals made by the court in so many cases of very petty offendings. The main criticisms of the juvenile liaison idea have been aimed at this positive alternative, the assumption by the police of a supervisory interest in the child. The present study will go on in due course to assess this more controversial function. Meantime, some data from a sample survey of recent cases are available. The average time given to active supervision of a case in Greenock is nine months. Some cases were followed up for periods of four, five or six months; in others supervision went on for fifteen, seventeen, eighteen, and over twenty months. On the average, five home visits were paid, the smallest number of visits being one and the largest fifteen. One can gather from this that the work of home visiting is being done thoroughly, perhaps too thoroughly in some cases. There is considerable uncertainty about the amount of time that should be spent on cases, and the different police schemes vary considerably in their practice as regards duration of active supervision. In Greenock, one senses a certain difficulty about when to leave a family to stagger along by itself—a crucial case-work situation—and a certain real need for guidance and assistance.

This suggests that police juvenile liaison schemes might well look to other services for advice and help in this matter of supervision. Perhaps the police could call on the services of people in the voluntary social services to take over the work of home visiting where the prospect of further delinquency has receded and the family still need a helping hand. It may be also that, if the climate of opinion in the probation service changes and as the heavy case-loads at present endured by probation officers are lightened, the probation service itself might co-operate in the supervisory side of the work—and also, for that matter, help with allocation.

The Future of Police-Public Relations

There are, however, some general grounds for arguing that the police should not hand over the work of juvenile liaison supervision entirely to some other agency, but should maintain a major interest in supervision, with all the implication of special social work training which this involves. The juvenile liaison schemes are the germ of an important development in police relations with a sector of the public which has hitherto been highly suspicious of the police where it has not been actively hostile to them. Hitherto parents in what may be called the delinquency-prone social groups have regarded the police with some resentment because the police rôle appears to be that of bringing children to court for whatever minor offence might have been committed. Juvenile liaison shows the police in a new light; police officers are offering to help parents to keep their children out of trouble and to avoid a court appearance wherever this is practicable. It may be that the image of the police as visualised by the formerly depressed social groups may change considerably and for the better as a result of police-parent liaison. This could be an important influence on public attitudes in the more generally affluent society which is taking shape. As the bulk of the population come to have a substantial stake in the national welfare it is desirable that they should respect and support the police as the defenders of law and order. Children today are becoming accustomed to treating the policeman as a friend and as a guide, as a result of the traffic lessons and demonstrations given by the police inside and outside the schools. Juvenile liaison brings the police closer to the parents as well as the children. It personalises authority, gives it a kindlier face, makes the agencies of social control more approachable and less fearsome.

It is not to be supposed that such a development would be universally welcomed. The existing system of rôles and images has the advantage of being simple and clear-cut. The policeman is the stern agent of law enforcement, the bogyman to frighten the children with; the probation officer and the social case-worker are seen as the symbols of public concern and understanding and positive help. The British public in all classes of society is highly ambivalent in its attitude towards authority. We resent authority when it impinges on us personally (as, for example, when we are found to be exceeding the speed limit); we respect and uphold authority when it protects us from the folly and evil-doing of others (such as careless drivers). There is a certain admirable clarity in the idea of putting this ambivalence to work, by arranging that our healthy resentment of authority should be projected exclusively on to the police, while our basic respect of authority is channelled in such a way as to strengthen the probation officer in his task of tempering justice with mercy and understanding. But this allocation of rôles is not true to the facts of history. The police in this country have always exercised their primary function of law enforcement with a friendly discretion in the case of delinquent children. We have already noted that juvenile liaison, and the other ways in which the police are improving their relations with children and parents of the formerly deprived social groups, is essentially an attempt at re-interpretation in urban conditions of the traditional rôle of the country policeman. It is not obviously desirable that this attempt should be abandoned. It is appropriate to an authoritarian society that the police should be functionally efficient, centrally controlled, remote and feared. In a free and open society such as ours aspires to be, it is desirable that the police should be humanly efficient, locally controlled, known as individual persons, and part of the community.

Note

The raising of the age of criminal responsibility from eight to ten years, foreshadowed in a recent government statement, opens up new aspects of the problems just discussed. The decision that the courts should treat children under ten as cases requiring care and protection will be valueless unless the courts, or the agencies to which they refer the children, are given the resources in equipment and staff to deal more adequately than the court at present does with many of its small child offenders.

If adequate resources are made available to courts there will be the less need for supervision by police juvenile liaison officers in the case of those younger children—unless, of course, such new developments in court procedure as may come about are influenced by considerations about the changing rôle of the police in relation to the public of the kind set out above.

CURRENT SURVEY

RESEARCH AND METHODOLOGY

CURRENT RESEARCH LXXXIV

(*Continued from Vol. 3, p. 283*)

GROUP SIZE AND GROUP PROCESSES IN APPROVED SCHOOLS

(1) *Name of University Department, Hospital or other Institution or private person supplying the information*: Dr. Howard Jones.

(2) *Subject of Research.* A study of the effect of the size of inmate groups in approved schools upon the effectiveness of the rehabilitative work carried out in them. It is hoped that this will widen out into an examination of the most effective ways of working with inmate groups of different sizes.

(3) *Under whose auspices is the research being carried out?* The University of Leicester, with the financial support of the Home Office. Director: Dr. Howard Jones. *Research workers*: D. J. Peryer and A. Robertson.

(4) *Commenced*: October 1962. *Completion expected*: approximately Autumn 1965.

(5) *Publication*: none to date.

CURRENT RESEARCH LXXXV

FAMILY RELATIONSHIPS AND RECIDIVISM

(1) *Name of University Department, Hospital or other Institution or private person supplying the information*: Institute for the Study and Treatment of Delinquency.

(2) *Subject of Research*: The family relationships, as described by the psychiatric social workers' reports, of 200 youths aged 14–16 treated at the Portman Clinic in 1939–42, in relation to their subsequent convictions.

(3) *Under whose auspices is the research being carried out?* The Institute for the Study and Treatment of Delinquency, with the help of a grant from the Prynce Hopkins Trust. *Research worker*: Dr. Skarbeck under direction of Dr. T. C. N. Gibbens.

(4) *Commenced*: July, 1962. *Completion expected*: 1963.

(5) *Publication*: No results published.

DESIGN FOR A PROPOSED STUDY OF VIOLENCE: A SOCIO-PSYCHOLOGICAL STUDY OF A SUBCULTURE OF VIOLENCE

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Introduction and Preliminary Assumptions

IN the development of criminology occasional opportunities occur when it is possible to link theory with fact and sociological with psychological perspective. Such an opportunity, we believe, is presented with the subculture of violence thesis. In a recent article ("Subculture of Violence: An Interpretative Analysis of Homicide") we have briefly outlined the argument for this thesis.

> "The deviation is from an accepted, prevailing legal and communal norm that places high value on human life and non-violent behaviour. The presence in society of a subculture of violence has been subsumed from the significantly high rates of homicide among particular groups. The concomitance of meaningfully related variables to this subculture strengthens the contention of its existence. The more integrated this subculture is, the more deeply internalized in the individual is the value of violence.
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> "The internal need for aggression and the readiness for the use of violence of the individual who belongs to a subculture of violence must find their psychological foundation in personality traits and in attitudes which can, through careful studies, be assessed in a way leading to a differential psychology of these subjects. Psychological tests have been repeatedly employed to study the differential characteristics of criminals and, if the theoretical frame of reference of acceptance of a subculture of violence is used, it will be possible to sharpen their discriminatory power."

There is some evidence that social class difference in child-rearing practices (Havighurst and Davis, 1946; Sears, 1943; Bossard, 1948; Gold, 1958; *et al.*) produce differential attitudes and conduct relative to the use of physical aggression. The socialisation process is in part built around a complex of attitudes and values transmitted by parents and significant others in the life of a child. When these values are shared by a group, when they are manifested as norms prescribing conduct for group members, when many critical parts of these norms are different from the normative system of the larger society, we may refer to the existence of a subculture. If the norms are not only different but also generally in conflict with those of

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the larger society, the subculture may be referred to as a contraculture (Yinger, 1960), as is the case with delinquent gangs or organised crime. It is in these general sociological terms that we have come to refer to a subculture of violence. The conceptualism suggests that there is a segment both apart from, and a part of, our dominant culture that places positive merit in the use of violence in interpersonal relations, that not only tolerates but even encourages or prescribes physical aggression and assaultive conduct under certain life situations. So deeply internalised are these norms and the violence value that they have become an integral part of the personality structure of the individuals who share in and are committed to them. While violence may not be a way of life for these groups, it is nonetheless a common experience, an expected form of response to an abundant set of social stimuli, a presumed quick and ready way to solve problems.

The evidence needed to define and to describe more adequately the existence of this subculture is either lacking or somewhat tautological. It may be found either in theoretical formulations or in phenomenological studies of particular kinds of crimes which are presumed to be committed mostly by persons whose normal patterns of conduct are based upon values shared by groups which support assaultive reactions. While a criminal assault is an obvious indicator of resort to violence, the act *per se* does not prove the existence of supportive groups, for it may be an idiopathic, not a normatively prescribed response, *i.e.*, it may belong to the idioverse and not to the universe of the criminal.

In a separate paper we tried to define and describe the meaning of subculture in general with a view to establishing some tangible theoretical parameters to the presently elusive term. At the same time, it is important to state clearly the necessity to move interchangeably from sociological to psychological theory and concepts as well as from empirical data in the one discipline to the other in the study and analysis of a subculture of violence. But perhaps most importantly we attempt in the instant research to establish a disciplinary duality in binding theory to scientific data; to move smoothly and in both directions from the gross to the refined, from the macroscopic to the microscopic perspectives without distortion or loss of either sociological theory or psychological data. Of the area specialties in sociology, criminology especially has suffered from disciplinary isolation while having more abundant opportunities than any other area for integration. Perhaps it has been the wide breadth and scope of criminological investigation, aetiology and treatment that have both encouraged scholars from many disciplines to study and at the same time permitted insularity to develop.

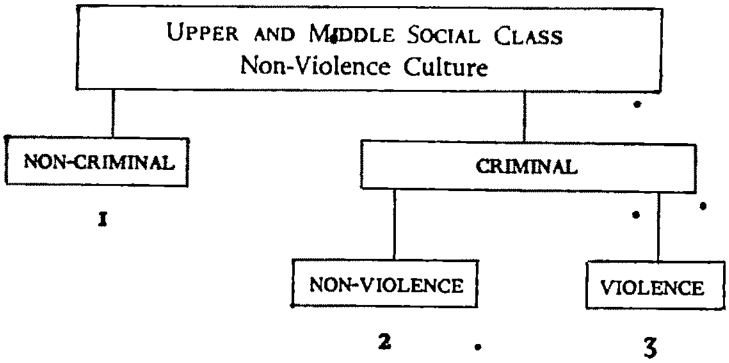
That (1) a subculture of violence exists and that (2) it exists in representative, identifiable individuals, are assumptions underlying this research. The former requires further development of the theory with a subset of propositions and hypotheses that can be tested. The latter requires application of validated psychological instruments for determining differences between individual subjects whom the theory identifies as belonging to the subculture. The present research is not a definite nor exhaustive treatment of these issues but should be viewed as more than heuristic. It is an attempt to produce some findings that will more firmly establish a subculture of violence and that will provide meaningful suggestions for further research and analysis.

Previous criminological literature has described the social structure and social values of ecological areas (Shaw and McKay, 1942; Kobrin, 1951; Lander, 1954) and of cultures in conflict (Sellin, 1938; Whyte, 1960). More recent delinquency theory refers to differences between the middle class and working class ethic (Cohen, 1955); the criminal, conflict and retreatist subcultures (Cloward and Ohlin, 1961), techniques of neutralisation (or rationalisation) (Sykes and Matza, 1957), and a subculture of violence relative to homicide (Wolfgang, 1958; Wolfgang and Ferracuti, 1961). The psychological literature on aggression has recently been summarised by Buss (1961) and by Berkowitz (1958). Specific regional differences in subcultural allegiances have been described by some authors (*e.g.*, Pigliaru, 1959). Based upon some of these ideas, the present research postulates that the larger dominant culture, which has principally an upper and middle class ethic responsible for both codified and communal norms, is a non-violent culture. This culture views the use of physical violence in interpersonal relationships as antithetical and deviant. Furthermore, a large portion of the lower social class adheres to this culture theme although not enjoying many of the institutional means for imposing (through legislation) or requiring (through judicial rôles) commitment to it. But another portion of the lower social class, for a variety of reasons to be discussed later, has become imbued with a tolerant acceptance of violence that in itself is a normative system. Individuals in this subculture go through a learning process (socialisation) that is similar to that for those in the larger non-violent culture and therefore perceive a considerable amount of violence as a normal pattern. The perceptual habits, once established, should be detectable through projections of the individuals.

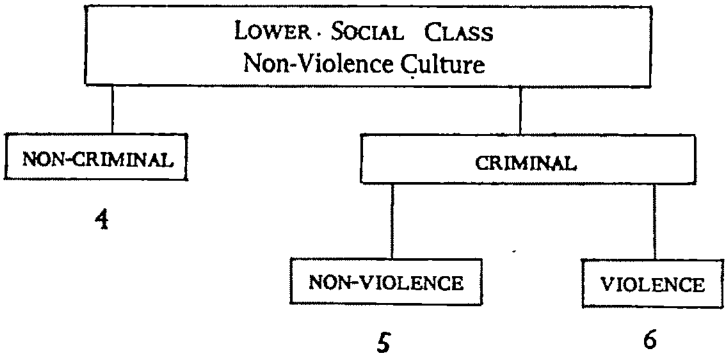
Our task becomes one of testing, through psychological projective procedures, some of the hypotheses emerging from these propositions about the non-violence culture and the subculture of violence. We intend to obtain samples of nine different subgroups for refined personality examination, hypothesising points of significant differences or similarities. These nine subgroups should be viewed as ideal types in the Weberian sense. The following chart shows the general schematic approach and the categories from each of which approximately ten subjects will be tested.

We have used a class dichotomy of upper/middle and lower. The reasons are the following. (1) The codified and communal norms of the dominant culture in the Western civilisation historically and at present come from upper and middle class social values. (2) These values and the norms of conduct they support are essentially non-violent except when the whole society

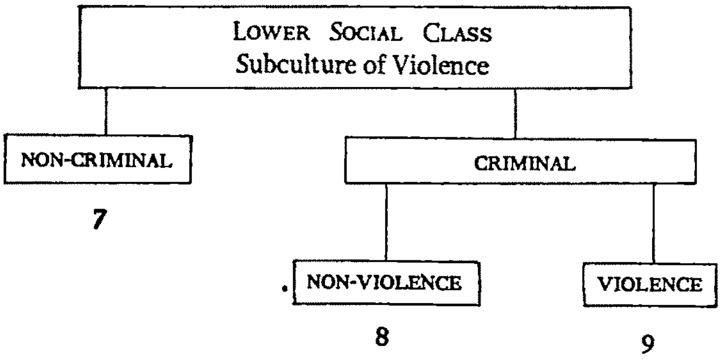
I.



II.



III.



is attacked by an outside group. (3) Criminological research has generally found that a disproportionately high number of offences of violence are committed by members of the lower social class. (4) Social class theory in criminology and empirical data in stratification point to differences in child rearing that are related to the use of physical aggression.

But because a large portion of the lower social class is essentially law abiding and because crime and delinquency converge with many other social problems on a limited segment of this class, there is logical justification for assuming that there are differences between these two portions of the lower class that are meaningful to the focal concern of this study. Thus, we would assert, without presently knowing the extent, that there is a large portion of the lower class committed to the dominant non-violence culture; and that there is another portion of this lower class which contains some values regarding the use of violence which are antithetical to the dominant culture. This last group we refer to as the subculture of violence.

These comments explain why the previous chart has three major groups based upon social class and value systems regarding the use of violence.

The subgroups under each of the three major groups have the same nomenclature: non-criminal, with no further breakdown; criminal, divided into non-violent and violent. The focus of the research is on criminal violence, and therefore we need to examine in as pure form as possible the violent criminal. This means also that we must distinguish him from the non-violent criminal and the non-criminal in each of the three major groupings and between groupings. Moreover, our underlying theory of a subculture of violence does not preclude the commission of a violent crime by individuals classified as belonging to a non-violence culture; nor does it deny that many persons belonging to a subculture of violence are non-criminal. For these reasons, all three subgroups—non-criminal, non-violent criminal, and violent criminal—must appear in each of the major class-culture groups.

It is obvious that to use the subculture of violence frame of reference does not exclude other cultural and non-cultural motivations to commit acts of violence. These other motivations may well cut across subcultural boundaries and cause individuals not committed to violence to resort to it as an extreme non-duplicable problem-solving process alien to their life history and to their *Weltanschauung*. In this sense it is an "abnormal reaction" (K. Schneider, 1953), and as such must fall outside traditional sociological variables. However, the subculture of violence postulates a more frequent, more probable, and more "normal" use of violence. By way of illustration, we would hypothesise that:

(1) The upper/middle class offender who commits a crime of violence, such as homicide, does not represent a norm of violence but has a pronounced abnormality in his personality in contrast to the lower class offender from the subculture of violence.

(2) Most non-criminal and non-violent criminals who are psychologically similar to violent criminals from the subculture of violence will belong to that same subculture.

(3) Non-criminal and non-violent criminals from the lower class non-violence culture are more similar to non-criminal and non-violent criminals from the upper/middle class than to any other groups.

(4) The violent criminal from the lower class non-violence culture is, like the upper/middle class violent criminal, more psychopathological than the violent criminal from the subculture of violence.

Aggression, from a psychological standpoint, has been recently defined by Buss (1961) as "the delivery of noxious stimuli in an interpersonal context." Aggression seems to possess two major classes of reinforcers: "The pain and injury inflicted upon the victim and its extrinsic rewards." Both reinforces are present in a subculture of violence, and their mechanism of action is facilitated by the social support that the aggressor receives in his group. The relationship between aggression, anger and hostility is complicated by the habit characteristics of the first, the drive state of the second and the attitudinal, interpretive nature of the third. Obviously, the immediacy and the short temporal sequence of anger with its autonomic components make it difficult to study a criminal population that is some distance removed from the anger-provoked event. Hostility, although amenable to easier assessment, does not give a clear indication or measure of physical attack because of its prevalent verbal aspects. However, it may dispose, or prepare aggression. The latter, in its physical manifest form, remains the most criminologically relevant aspect in a study of assaultive behaviour. Our approach to the study of aggression does not make use of the well-known frustration-aggression hypothesis which recent reviews tend to discard (Buss, McNeil), but instead conceives of aggression as a learned response, socially facilitated and integrated, in more or less permanent form, among the personality characteristics of the aggressor. Therefore, being a habit and possessing permanent or quasi-permanent personality trait characteristics, it should be amenable to psychological assessment through appropriate diagnostic techniques. Among the several alternative diagnostic methodologies, those inspired to a perceptual approach seem to be able, from existing literature, to elicit signs and symptoms of behavioural aggression, proving the existence of this "habit" and/or trait in the personality of the subject being tested. Obviously, the same set of techniques used to diagnose the trait of aggression can be used to assess the presence of major psychopathology which might, in a restricted number of cases, have caused "aggressive behaviour" outside of, or in spite of, any cultural or subcultural allegiance.

Research Procedures and Methods

Preliminary work was begun from September to December 1960, during which time plans were prepared for an ecological study of violence in Metropolitan San Juan. Data from this study will be used as background information for the present integrated research project and will be made available as soon as analysis is completed.

Our research has a limited scope. We are not seeking to generalise about the whole universe of criminal offenders; we are not, for the present, trying to determine the extent of a subculture of violence in a non-violence culture; and we are not now designing a study of the proportional involvement in violent and non-violent crimes for any groups. These latter issues are certainly important and will require further attention later. They also will require representative sampling procedures in the research design.

For the present research it is important to obtain cases empirically that conform to the ideal types in the basic group designations outlined in a previous section. The procedure for selecting cases, therefore, does not demand representative sampling. Purposive selection based upon certain criteria of specified social variables is the procedure used in the present study.

These selective criteria for each designated group, along with definitions of terms where needed, appear in the Appendix. In general, the study includes only males between ages 25 and 45. The study is restricted to males because there are relatively few females in prison or gaol available for testing, because very few females commit crimes of violence (which is a fact of theoretical relevance for the interpretation of our findings), and because psychological studies show that women have fewer covert as well as overt aggression patterns. The ages 25 to 45 were chosen in order to permit sufficient time in the life history of the individual both to establish a habit strength of aggression or non-aggression and to be guilty of an offence of violence. It is well known that the great majority of persons arrested and convicted for assaults committed these offences in their twenties or early thirties. If by age 45 an individual has no criminal record or none for assaults, the probability of his acquiring a record is considerably low. Because we are seeking non-criminals we wanted to allow adequate time (at least 25 years of age) for criminality to be expressed in a way that would be reportable to the public authorities. The upper age limit is somewhat arbitrary but certainly not restricting. For the criminal groups, we also were concerned that not too much time elapsed between arrest and the date of selection for study, where some degree of prisonisation might bias and disturb the results on projective tests designed to obtain data about a personality whose psycho-cultural reinforcements occurred prior to prison experience. Also, this will avoid acculturation to violence within the prison community. Therefore, the maximum amount of time between arrest and selection was set at four years. This choice of a time limit was based upon previous studies of the social psychology of the prison community and its effects upon prisoners.

Occupation and education were used as rough indices of social class and to some extent to differentiate the two lower class groups. The kind and number of previous contacts with the law further distinguished subgroups, once assigned. In this study, previous criminal record refers to any arrest record, whether or not conviction ensued. Additional specifications and items regarding the criminal record of relatives are indicated in the Appendix. The combination of all these variables should provide distinguishable groups to fill ideal typical cells of the schematic design.

Cases were obtained from those consecutive convicted offenders who came before the classification board. The board classifies all felons from Puerto Rico and all misdemeanours from San Juan, and approximately forty or forty-five cases appear for classification each week. Aware of the specifications of our groups, a psychologist, who is a member of the classification board, has selected cases as they came in and which were needed for our study. Cases that could not be obtained in reasonable time this way have been taken from the central file on all inmates presently in custody in various types of institutions. A random process of examining the files of nearly 4,500 inmates has been followed until the needed cells were filled.

The non-criminal group belonging to the subculture of violence will be obtained from the relatives of violent subculture offenders in prison (see Appendix), whereas non-criminals from the upper/middle and lower non-violent classes will be obtained from ecological areas with low crime rates and from families known by the research staff to fulfil the selective criteria of these groups.

Ninety subjects altogether, or ten in each subgroup, will be given the following psychological tests:

(1) *Ohio Penal Classification Test.* This non-verbal test will measure the I.Q. of the subjects, in a relatively quick and reliable way. It has a correlation (corrected for attenuation) of ·90 with the Wechsler-Bellevue Scale and appropriate norms for the Puerto Rican population are already available; intelligence, although not being primarily a relevant variable in this study, must be determined in our population to exclude grossly deviant cases.

(2) *Bender Visual Motor Gestalt Test.* This short motor perceptual test will be used to screen from our groups subjects presenting organic brain pathology and perceptual disturbances.

(3) *Rorschach.* This test will yield a comprehensive personality evaluation, will permit measurement of the normality or abnormality of the subject, and through the use of one of the existing content scales for aggression, will permit a direct evaluation of the existence of the aggression habit in our subjects.

(4) *Maps.* This test will permit duplication of the examination conducted through the use of the Rorschach at a different thematic level. The aggressive fantasies elicited can be examined in this test, both from the point of view of the subject's verbalisation and objectively, through the choice of figures. Five backgrounds (street, medical, dream, bedroom, shanty) will be given to each subject.

(5) *Buss-Durkee Inventory.* This inventory allows the assessment, at a conscious verbalisation and opinion level, of the presence of aggressive habits. It allows also differentiation of the relative strength of various offensive patterns

and has been presented, on factorial evidence, as capable of measuring both hostility and aggression.

All the persons belonging to the criminal population will also be subjected to a comprehensive medical examination, with a view to exclude those who present medical or neuropsychiatric diseases (*e.g.*, epilepsy, Basedow, etc.) which might cause or facilitate aggressive behaviour.

The Process of Analysis

After data are assembled, the research supervisors will analyse them together. It should be stressed that this study has been interdisciplinary from the beginning, in establishing theoretical constructs and in designing the research. Analysis and interpretation of findings will be done jointly, not separately written and then spliced, in order to avoid discontinuity.

Significance of the Study

This research is designed to examine and analyse specific phenomena, the purposes of which have been outlined above. Results of the study will, it is hoped, contribute to:

(1) development of an integrated socio-psychological theory of criminal aggression;
(2) empirical testing of "middle-range" hypotheses emerging from the theory of a subculture of violence;
(3) expansion of interdisciplinary research in a meaningful area of human behaviour;
(4) establishment of a criminal typology based on socio-psychological theory and empirical data;
(5) use of typology in police administration, forensic medicine, and correctional philosophy and therapy;
(6) promotion of explorations in cross-cultural research and analysis.

Appendix

A SOCIO-PSYCHOLOGICAL STUDY OF A SUBCULTURE OF VIOLENCE
Specifications for Groups to be Tested

Attributes for all groups

1. Male.
2. Lower age limit of 25 years; upper of 45 years.

Attributes for the prisoner population

1. Male.
2. Lower age limit of 25 years; upper of 45 years.
3. Maximum amount of time from arrest to selection of case for research is four years.

DEFINITIONS

1. *Occupation.*

   For determination of category (professional, managerial, clerical, skilled, semi-skilled, unskilled, etc.) see the *Dictionary of Occupational Titles*, U.S. Department of Labour, Bureau of Employment Security, Second Edition, March 1949, and Supplement, March 1955.

2. *Previous Criminal Record.*

   Use of police files for determination of any arrest, whether or not conviction occurred.

3. *Relatives.*

   Only brothers and fathers are involved.
   Father refers to a biological parent.
   Brother refers to a full or half-fraternal relationship only if the brother was part of the nuclear family unit.

4. *Time.*

   The length of time between the date of arrest and the date of selection of the case for the present study.

5. *Criminal Status for Selection.*

   Any of the following assaultive offenses involving a *vis-à-vis* relationship between victim and offender:

First Degree Murder	*Asesinato en 1er. Grado*
Second Degree Murder	*Asesinato en 2do. Grado*
Voluntary Manslaughter	*Homicidio Voluntario*
Attempt to commit Homicide	*Ataque para cometer Homicidio*
Attempt to Kill	*Atentado a la Vida*
Attempt to commit Murder	*Ataque para cometer Asesinato*
Aggravated Assault and Battery	*Acometimiento y Agresión Grave*

6. *Violent Offence in Criminal Record.*

   This category includes all offences described in 5 above plus all other offences involving violent interaction, either actual or highly probable in *vis-à-vis* acts, including robbery, rape, etc.

7. *Non-violent Offence.*

   This category excludes all violent offences as described above. Any offence against property, morality, the public peace, etc. that does not involve violence or threats of violence to the person or the government is included in this category.

8. *Instant Offence.*

   This is the offence which resulted in the offender's commitment to the correctional institution at the time he was selected for the present study.

GROUP DESIGNATION: 9

1. Culture Group - - - Subculture of Violence
2. Social Class - - - Lower
3. Criminal Status - - - Violent

SELECTIVE CRITERIA

1. Instant Offence - - - - Violent
2. Sex - - - - - Male
3. Age - - - - - 25–45 years
4. Time - - - - Four years or less
5. Occupation - - - Unskilled
6. Education - - - No high school
7. Previous Criminal Record - Three or more violent offences
8. Relatives - - - - Must have at least one brother who fits into one of the following:
    - (a) has the selective criteria for the group designation of subculture of violence, lower social class, non-violent criminal status;
    - (b) has the selective criteria for the group designation of subculture of violence, lower social class, non-criminal status.

Editorial Note.—*For reasons of space this Appendix has been cut down. The forms for the other eight groups of the sample are on similar lines with the modifications necessary to suit the respective characteristics of these groups, e.g., non-violent, non-criminal, upper or middle class, etc.*

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NOTES

THE AGE OF CRIMINAL RESPONSIBILITY

THE question whether and by how much the age of criminal responsibility should be raised in English law has been under more or less constant discussion in this country for at least a quarter of a century. First, before the last world war, the raising of the minimum age to the continental level of thirteen, fourteen or even higher was suggested mainly by a few lonely voices crying in the wilderness such as Miss Elkin in her *English Juvenile Courts* (1938) and the author of the present Note in his *Dilemma of Penal Reform* (1939). In the course of a lengthy discussion of the problem (pp. 177–201) the latter pointed out that the English juvenile court presented an ideal opportunity of demonstrating the incompatibility existing between some fundamental principles of legal doctrine and the special needs of certain categories of offenders. "The chief difficulty of this institution," he wrote, "lies in the fact that it is both a Criminal Court and a Children's Court, for a Children's Criminal Court is a contradiction in terms," and although the juvenile court is not only a criminal but also a civil court, "as is usually the case with social institutions of a mixed nature, it receives its predominant character and reputation from that part of its activities which is most in the public eye and this, for reasons of greater frequency and sensationalism, is the criminal part." Having given the juvenile court the task of investigating criminal charges, the legislator was now forced to work out a compromise procedure which, while preserving the essential features of a criminal trial, would at the same time try to adapt them to the needs and mental capacity of a child or young person, but "is it possible to have it both ways?" The conclusion was that in spite of all the efforts made in this direction, no really satisfactory solution had been found or could be found. The child needs psychological understanding, but criminal court proceedings are, almost by definition, unpsychological. "The treatment of juvenile delinquency in court has now reached a stage where the young offender is dealt with very kindly and with the greatest consideration. What is still missing is to treat him not—as at present—as an adult in miniature, but as a child . . ." He concluded that "children of elementary school age should never be dealt with by a court which imposes penalties and is therefore, in substance, a criminal court" (p. 190), and it is obvious that the younger the child the greater will be the difficulties referred to.

A few years after the war, the Howard League symposium, *Lawless Youth*, was published (1947) in which Dr. Grünhut surveyed the international position as it was at the time. He observed that "the more a thorough social and educational service by a court, a youth welfare authority, or the co-operation of both, has been developed and is working satisfactorily . . . the more can the lower age-limit of a juvenile court for offenders be raised," and suggested that it should be raised to fourteen years (p. 30). The Howard League for Penal Reform, through its late secretary, Miss Cicely Craven, also produced certain detailed proposals for reform (*The Howard Journal*, Vol. VII, No. 1, 1945–46).

In the special number of the *British Journal of Delinquency* on juvenile courts (Vol. VII, No. 3, January 1957), Miss Eileen Younghusband remarked, "it is hard to justify our practice of bringing children before courts on criminal charges" (p. 193).

Dr. Peter Scott, examining the juvenile courts from the juvenile's point of view, found that there were some children who, when appearing in court, were "so disturbed that their feelings and reactions could not be much altered by changes in court procedure, nor by the attitudes of the magistrates" (Vol. IX, No. 3, p. 211) and Mr. P. M. W. Voelcker, studying the parents' point of view, regarded as the major problem "the reconciliation of the juvenile court's two roles of court of justice and treatment tribunal" (*British Journal of Criminology*, Vol. I, No. 2, p. 165).

The discussion of the matter in the Ingleby Report of 1960 is neither very detailed nor profound or original, but the Committee at least recommended the raising of the minimum age to twelve, with the possibility of its becoming thirteen or fourteen at some future date (pp. 30–31, 35, 154).

The next step was taken at the end of 1962 when the Government proposed, by an amendment to the Children and Young Persons Bill, to raise the minimum age to ten. Lady Wootton, however, succeeded in getting a majority of one in the House of Lords for it to be raised to twelve. It was a courageous move and a remarkable victory for reason, but it proved to be only short-lived. In January 1963, the House of Lords was back again to ten, this time by 41 votes to 27 (*The Times*, March 25, 1963). A concession was made by the Government by adding a clause according to which " In proceedings against people aged 21 and over any offence of which a person was found guilty while under the age of 14 should be disregarded for the purposes of any evidence relating to previous convictions." Such a provision will no doubt help to reduce the stigma at present attached to findings of guilt by juvenile courts, but it will not remove it altogether. And why does it apply only to people aged 21 and over? What about those between 17 and 21?

Meanwhile we read in an article on the subject by a " Medical Correspondent " in *The Times*, of February 11, 1963, that " tinkering with anything so fundamental as the concept of responsibility will hinder rather than help." However, most of those to whose views we have been referring, do not wish to tinker with the concept of criminal responsibility as such; what we want is merely to tinker with obsolete age limits, and some of us will, I am sure, continue to do so in spite of the " Medical Correspondent."

Somewhat surprisingly, neither the Ingleby Report, nor the " Medical Correspondent," nor apparently the Government, have taken the trouble to refute what seems to be one of the strongest arguments in favour of raising the lower age limit to a level higher than ten or even twelve, *i.e.*, the reluctance of many people, including in particular headmasters, to bring children of school age before the juvenile courts on a criminal charge (on this see, *e.g.*, my *Juvenile Delinquency in an English Middletown*," p. 48, and *Social Aspects of Crime in England between the Wars*, pp. 80–81). Even if it should be true that this reluctance should have become slightly less pronounced in recent years, enough of it has remained to make an even larger slice of juvenile delinquency inaccessible to the remedial work of the juvenile courts than would be the case with other agencies which do not carry the stigma of a semi-criminal court. Here again, the provision referred to above now proposed by the Government concerning findings of guilt incurred before the age of 14 should help to reduce, but it will not altogether overcome that widespread reluctance because it deals only with one aspect of the matter and leaves others untouched. Moreover, to take up one of the points made by Mr. Mack in his article in the present issue, the high proportion of juveniles under fourteen dealt with by absolute or conditional discharge seems to show that the juvenile courts, too, regard in many cases court proceedings as unnecessary.

Nearly forty years ago, a Bill of 1924 proposed already to raise the age limit to at least ten years (*Dilemma*, p. 190, n. 1). At the present rate of progress we may expect to reach the twelve years' limit by the end of the century.

H. M.

DELINQUENT GENERATIONS? [1]

A. A. WALTERS *

1. The main purpose of this note is to show that the hypothesis that there were delinquent generations born in 1935–42 is discredited by the data. This hypothesis has previously been challenged on various grounds. Mr. Prys Williams, in his study, *Patterns of Teenage Delinquency*, has clearly shown the critical effect of analysing *all* offences including those which are non-indictable. Similarly, Mr. Michael Power has reported from a study in East London that there is a substantial variation in types of offences and that the legal categories obscure many of the interesting features (see *The Times*, August 9, 1962). These results are most valuable in assessing the validity of the delinquent generation hypothesis (hereafter called the D.G.H.). For indictable offences, however, I do not think, that the main result of the Home Office Report has yet been discredited by the evidence There does still appear to be some strong support for the D.G.H. for indictable offences. The particular object of this note is to show that *given the evidence on indictable offences in the Home Office Report, the alleged support for the D.G.H. is a statistical illusion due to two more or less independent trends in the data. When these trends are removed any statistical support for the D.G.H. disappears.*

2. In Table 1 we reproduce Table 3 of the H.O. Report. The figures give the rates of delinquency for males. (Ignore for a moment the figures in brackets.) Two features of this table are remarkable. First there has been a marked decline in the rates for young males (*i.e.*, 8–11) from the year 1951 or 1952 to 1957. This effect may be either real, or a quirk of statistical selectivity, or some combination of the two. My impression is that at least part of the decline is due to the police not pressing cases which they would have pursued in earlier years. (Presumably this impression could be checked by comparing delinquency rates in areas where it is known that the police use welfare or liaison officers instead of the court with ones where the prosecution is pressed.) It is clear that this trend has little to do with the delinquent generations—unless one postulates a complicated and, I think, impossible

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[1] *Delinquent Generations* by L. T. Wilkins. A Home Office Research Unit Report, H.M.S.O. 1960.

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" feedback " effect from the older to younger children. We can clearly dismiss this explanation at this stage of inquiry.

3. The second main trend in the data is clearly the rise in the delinquency rates of young men (age 17–20) in the years 1956–57. From various other pieces of evidence it seems likely that this is a real trend and is not an illusion due to the vagaries of police practice. As Wilkins points out in the H.O. Report, the D.G.H. cannot explain all the rise in the delinquency rates of young adult males. " It seems that this pattern is an example of a wave of a different type from those seen earlier in this birth group, for other birth groups and for females " (*op. cit.* p. 10). This trend may be connected with the D.G.H. by postulating a " time-lag " reaction. But, as Wilkins shows, this explanation is not consistent with evidence on females. We might then suppose that this increase in young adult crime is largely independent of the D.G.H.

Now let us examine the table of delinquency rates. It is not obvious that there is a generation effect from this tabulation. The table is, of course, arranged in such a way that it is not easy to see whether there is or is not a generation effect. The eye does not naturally travel along diagonals. It is, however, clear that the two trends discussed above will give the *appearance* of such an effect since they are in the form :—

Age
High Low
Year ↘
Low High

The natural question is then: can the alleged support derived for the D.G.H. be attributed to these two trends in the data?

4. To examine the D.G.H. we must first remove from the data these two trends. Neither of these trends, and especially that of very young offenders, has any close connection with the D.G.H. and if we leave them in the data we shall get the above distortion. Eliminating trends is an arbitrary business. I have chosen a method which is mostly easily understood and which the reader himself can easily change to observe the effects of varying the assumptions. I have supposed that the values of the rates are the constants shown in parenthesis in Table 1. Thus we suppose that the eight-year-olds have a constant rate of 490 from 1951 to 1957. Whether the bracketed values represent the rates we should have got in the absence of the two trends is a judgment which the reader must make for himself. (I have tried experiments by slightly increasing the assumed rates for young adult males to take account of the assumed generation effect. It does not appear to have any very marked effect on the results.)

Now in order to compare these effects with the results of the H.O. Report we have used exactly the same statistical technique. We have calculated the " expected " values by the rule

TABLE I

Rates (per 100,000 of the related population) for males aged 8–20 years of age found guilty of indictable offences in the years 1946–57, England and Wales

Year	8	9	10	11	12	13	14	15	16	17	18	19	20	Average Rate	Rate directly calculated
1946	426	829	1182	1408	1562	1709	1486	1716	1708	1534	1135	1093	824	1278	1276
1947	435	808	1096	1296	1541	1729	1463	1516	1562	1404	1030	1096	822	1215	1211
1948	517	990	1341	1669	1941	2184	2322	1809	1597	1412	1108	1135	983	1462	1459
1949	487	949	1284	1560	1803	1986	2160	1543	1417	1162	1002	934	810	1315	1319
1950	488	987	1399	1667	1872	2101	2303	1540	1415	1292	933	958	823	1368	1371
1951	479 (490)	962	1410	1734	2102	2422	2699	1831	1582	1509	1123	1063	965	1529	1529
1952	377 (490)	810 (950)	1201 (1350)	1679	1908	2270	2505	1778	1640	1517	1178	1086	937	1453	1442
1953	368 (490)	694 (950)	1012 (1350)	1314 (1680)	1654	1926	2115	1474	1392	1294	1033	923	839	1234	1222
1954	291 (490)	599 (950)	854 (1350)	1090 (1680)	1411	1794	1975	1404	1271	1179	982	949	778	1121	1100
1955	228 (490)	575 (950)	888 (1350)	1098 (1680)	1383	1713	2068	1451	1324	1239	1043	1040	841	1145	1099
1956	246 (490)	487 (950)	859 (1350)	1148 (1680)	1458	1846	2188	1631	1509	1434 (1400)	1218 (1100)	1207 (1050)	1261 (850)	1269	1213
1957	290 (490)	586 (950)	840 (1350)	1275 (1680)	1620	2029	2438	1844	1835	1780 (1400)	1617 (1100)	1451 (1050)	1339 (850)	1456	1405
Average	386	773	1113	1411	1688	1976	2143	1628	1521	1396	1117	1078	935	1320	

$$\text{expected value at age i in the year j} = \frac{(\text{average for age i}) \times (\text{average for year j})}{\text{average over all years and ages}}$$

Then we have calculated the deviation of the observed rate from the expected rate and expressed this as a percentage of the expected rate, *i.e.*,

$$\frac{\text{observed} - \text{expected}}{\text{expected}} \times 100$$

The results are shown in Table 2. In the last but one row we have shown the average. For comparative purposes we also reproduce the averages calculated in precisely the same way in the H.O. Report (p. 15).

I believe that this table largely speaks for itself. Certainly there is no evidence in my averages of the high values which were encountered in the 1935–1940/2 group by Wilkins. Nor are there any large negative averages among the younger generations (right-hand side of the table). These effects have been eliminated by washing out the trends.

Returning now to the D.G.H. we see that if we add the averages of the delinquent generations in my table we get a value of −0·2. If we add those obtained by Wilkins we get a value of +60·3. In my table there is no clear run of high values over any significant group of generations. I conclude

TABLE 2

Percentage by which observed crime rate was greater or less than the " expected " rate
Males born in the years

Year	1925/ 1926	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37
1946	1·6	12·4	13·2	19·6	19·2	11·9	−26·4	−8·2	−1·8	−7·7	−4·8	−6·0
1947		6·6	18·6	8·0	15·1	14·6	3·9	−23·8	−2·4	1·9	−10·6	−7·2
1948			5·9	2·1	−3·4	−3·9	−2·6	3·0	·4	2·5	6·6	−4·3
1949				−2·9	−6·7	−2·9	−12·0	−4·0	−2·3	3·9	3·7	10·1
1950					−5·2	−7·9	−13·0	−5·9	−7·8	−6·2	6·5	5·4
1951						−·6	−8·7	−6·5	−1·8	−7·8	−·3	11·6
1952							−·4	−3·8	1·2	1·8	−1·4	−·2
1953								·4	−7·9	0	−2·2	−5·8
1954									−1·6	0	·3	−5·9
1955										4·0	7·2	4·3
1956											−·5	2·5
1957												−6·6
Average	1·6	9·5	12·6	6·7	3·8	1·9	−8·5	−6·1	−2·7	−·8	·4	−·2
Average from H.O. Report	−9·0	0·2	3·5	−1·1	−2·6	−3·9	−13·1	−9·9	−5·3	−1·0	6·0	7·8

Maximu

therefore that the data provide no evidence to support the D.G.H. The evidence clearly suggests that there are the two trends discussed above. These two trends explain the illusion of support for the D.G.H. to be found in the data.

5. There is a methodological lesson to be learnt from this discussion. We should not normally use data to give expected values when there are marked and different trends in the time series. The expectations will be distorted and the deviations from expectations contorted by these trends. Indeed the trends may give rise to plausible but spurious support to alternative hypotheses. We cannot treat data of this kind as though they emerged from an experiment conducted under controlled conditions. We know that they did not.

The best approach is to try to sort out systematic effects in the basic tables using any *a priori* information available. If there are such effects which disrupt the homogeneity of the data, then that is as far as we can go. We cannot continue to test interaction effects *as though* the variations in the table were due to random causes only. This may seem to be a pessimistic conclusion; but I do not think it is.

The alternative interpretation of the data offered in this note is, of course, only one of the possible explanations. It is possible to shed further light on the plausibility of different hypotheses by examining data from other countries and, perhaps, for other post-war periods. For example, our confidence in the hypotheses would be critically tested if we knew the crime rate of very young offenders in the years before 1946—particularly the pre-war years. But these reflections clearly carry us far afield.

TABLE 2

Percentage by which observed crime rate was greater or less than the "expected" rate
Males born in the years

/38	38/39	39/40	40/41	41/42	42/43	43/44	44/45	45/46	46/47	47/48	48/49	Year
6·2												1946
3·6	·7											1947
5·6	−1·9	−·6										1948
−·6	·5	4·5	4·3									1949
0·0	2·1	5·3	4·7	·4								1950
8·6	10·3	−5·0	−5·2	−8·9	−9·9							1951
6·8	5·0	3·3	−5·1	−6·4	−7·2	−7·0						1952
6·8	1·6	·4	·9	6·9	5·5	4·5	4·7					1953
9·1	−6·3	·2	−1·3	−9·1	12·9	11·4	10·5	10·6				1954
3·2	−7·4	−5·2	2·6	−7·8	−12·9	10·5	9·0	8·1	8·2			1955
4·2	3·6	−·1	·9	2·8	−5·9	−13·0	4·6	3·2	2·3	2·3		1956
3·7	−2·2	−2·8	14·1	7·1	7·6	−2·9	−9·2	−1·8	−3·1	−3·9	−3·7	1957
−·8	·5	0	1·8	−1·9	−1·4	·6	3·9	5·0	2·5	−·8	−3·7	Average
8·3	11·4	10·9	11·6	4·3	−2·1	−8·7	−8·6	−15·8	−32·9	−32·5	−31·9	Average from H.O. Report

group born 1935–1941/2

COMPENSATION FOR VICTIMS OF CRIMES OF VIOLENCE *

GORDON ROSE

THIS Report is the latest move in a campaign which is beginning to accumulate a history of its own. Stemming from various suggestions, notably for an insurance scheme, made by Margery Fry at the end of her life, pressure on this subject led to the appointment of a working party of officials to study the practicability of introducing a scheme. This working party reported in June 1961,[1] laying great emphasis on the difficulties of producing a satisfactory plan, and suggesting two alternatives: either a scheme on the lines of the provisions for industrial injuries (which was Miss Fry's original suggestion), or a scheme based on direct grants assessed on the basis of common law damages with some changes in procedure. It was all made to seem so complicated, however, that nothing was done. As a result, "Justice" appointed its own committee.

It is clear from their Report that there is an underlying problem which could hardly be tackled by a working party of officials or, indeed, any government sponsored committee. This is the inadequacy of social insurance benefits, even industrial injury benefits which are higher than most. Any scheme of compensation must surely provide payments of a reasonable amount. Social service benefits are based on subsistence and even the 100 per cent. disability benefit is now no more than 97s. 6d. per week. The "Justice" Report argues that compensation should be based on loss of earnings rather than subsistence, partly because of the low level of benefit, and partly because it is flat rate and thus not related to the actual loss of income. This is in line with the move, now largely espoused by the Labour Party, towards graded contributions and benefits. It is not clear, however, whether this would mean full earnings or some proportion; or how earnings are to be assessed, sometimes a difficult matter. Nor is it clear whether, if the disablement was permanent, there would be any change in the payment made, either upwards to take into account loss of future greater earnings, or downwards, or what would happen in cases of partial permanent disability where earning ability was reduced. But there is also no reason why this scheme should be tied to social security benefits, and it would be tactically advantageous to regard it as a special case.

The Report also recommends a "first aid" benefit in a lump sum to be paid automatically on proof that the person concerned had been the victim of a crime of violence. To obviate fraud it is suggested that the police should certify that the claimant appeared to be the victim of a crime of violence, but senior police officers consulted on this were opposed to the idea, though

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* *A Report by JUSTICE*, Stevens, 1962, 31 pp., 7s. 6d.

[1] *Compensation for Victims of Crimes of Violence*, Cmnd. 1406, June 1961.

whether on the grounds of extra work or of putting the police in the false position of making judgments on a claim, is not stated. This could probably be got over by simply asking for the police reports and statements of evidence in the case, and supplementing these by a statement of the facts by the claimant and a doctor's certificate. The only additional role for the police would then be making the scheme known to a possible claimant and perhaps supplying forms. Even so payment could hardly be speedy.

The machinery suggested by the Report is an administrative tribunal known as the Crimes of Violence Compensation Board, which would normally decide on the basis of affidavits, but would hear evidence in disputed cases. This would consist of a legally qualified chairman, a doctor or person able to assist the Board on medical matters, and a J.P., one being a woman. There would be a full-time secretary and staff.

This is an attempt to introduce a judicial procedure without the delays of going to a court, but there seems to be no reason to depart from the usual administrative practice in determining claims of this kind, of leaving most of them to the administrators, and using an administrative tribunal for appeals. Most cases would presumably be straightforward and the main complications are possible fraudulent claims, the question of how far the victim was responsible for the incident leading to injury, and the possibility of collusion, or at least of the person responsible for the assault benefiting, in family quarrels. Perhaps some of these cases would also need to go to the tribunal for decision. It seems important, however, to avoid a situation where the amount given seems to depend, in the majority of cases, upon the decision of a tribunal, rather than upon a publicly stated proportion of earnings.

All schemes of this kind are full of intricacies and dangers. It would be difficult to maintain, however, that a scheme of this kind would be more hazardous to introduce and work than the first National Insurance Act of 1911, or even the recent scheme of graduated pensions. The major decision is not really one of means, it is one of policy. If the Home Secretary says that he wants to run a scheme, a viable scheme will be produced by his Department. The matter has now been explored sufficiently to show that it is, like many other things, difficult but not impossible. It is now for the Home Secretary to show that he has the necessary drive and vision to make the final decision.

THE NEED FOR CO-OPERATION IN SPECIAL SERVICES FOR THE CHILD DELINQUENT—AN APPRAISAL FOLLOWING THE INGLEBY REPORT

THE seventeenth Inter-Clinic Conference for Staffs of Child Guidance Clinics, organised by the National Association for Mental Health, and under the

Chairmanship of Dr. Edward Glover, dealt with the topic "The Child Guidance Clinic and Delinquency" and heard papers from two members of the Ingleby Committee, Mr. Donald Ford and Dr. Peter Scott, and from a psychiatric social worker, Mrs. Anneliese Walker.[1] The success of this conference indicated that a further conference, including other disciplines, would be valuable. Accordingly, the N.A.M.H. invited three leading members of related disciplines to address a second conference in November 1961.

Mr. R. H. Adams, Principal of Kingswood Training and Classifying Schools, Bristol, said that, despite 60 per cent. of approved schools having the services of visiting psychiatrists, there was considerable ignorance in the clinics of the functions of approved schools, as well as uncertainty of the proper role of the psychiatrist in the approved school system. Of 500 boys admitted to his school, nearly 50 per cent. had previously been examined by a psychiatrist, nearly 25 per cent. had attended a child guidance clinic for treatment, and 10 per cent. had been resident in schools for maladjusted children. To combat this, he suggested that the N.A.M.H., through the child guidance clinics, might arrange a series of small local study conferences to examine these matters, and that clinics should take more interest in those of their children who subsequently entered approved schools, and offer to participate in their further treatment. "A careful study of the intake to our classifying schools might well demonstrate the gaps there may be in the country's psychiatric services." On the whole, he felt, the child guidance clinics made little impact on children subsequently going to approved schools. Some even attribute their committal to having confided in a psychiatrist, whose report, they say, was read out in court and influenced the magistrates!

He suggested that there is a great need for work to be done within the boys' own home areas and with their families. There should be greater co-operation between day schools and child guidance clinics. He advocated an inquiry, under the joint auspices of the Home Office and the Ministries of Health and Education, into the possible contribution of day schools and other community services, especially those situated in high-delinqency areas, towards prevention of delinquency.[2] "Can we as a nation," said Mr. Adams, "afford not to act as if we really believe that prevention is better than cure?" He further suggested that it would be an interesting exercise for a university department, in a selected area, to arrange for a group of child guidance clinics, education authorities, children's departments, police authorities, probation departments, magistrates and others, "to elect delegates to a working party with a view to fresh thinking in the field of prevention, control and treatment of delinquency."

Miss M. Taylor, Chief Inspector to the Children's Dept. of the L.C.C., thought that the Ingleby Report, in pointing the way rather than solving problems, had presented a challenge which called for co-operation between all relevant agencies. Co-operation required mutual trust, knowledge and sympathy with the functions as between all the services, and must be based on genuine "concern" for the individual child. Regular meetings and personal contacts would promote this understanding.

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[1] "The Child Guidance Clinic & Delinquency," National Association for Mental Health, 39 Queen Anne Street, London, W.1. 1961, price 3s. 6d.

[2] Certain schools, for example that at Parsons Green, London, have already demonstrated successful pioneering endeavours along these lines. *Ed.*

In describing the function of children's departments, she mentioned a "preventive" function, a parental function, and a need to stimulate and keep alive the responsibilities of the parents and the community. There may be conflict between the local authority in its official and parental function.

Any service providing residential accommodation is vulnerable; practical difficulties of placement are inevitable; diagnostic reports should therefore take account of these difficulties and indicate "alternative recommendations." Children should be prepared more realistically for placement, by magistrates, probation officers and social workers. Child guidance clinics should be more accommodating in arranging urgent consultations, especially for older delinquent children in hostels and at work, thus supporting not only the child but the staff who care for him. In closing a case, account should be taken of the continuing responsibility of the children's department. Other services should be prepared to share the grave decisions and responsibilities imposed upon those responsible for children in care.

Better and earlier ascertainment is needed of the child with fundamental difficulties requiring specific types of placement or treatment. With the child already in care this is the more difficult on account of the obscuring effects of the separation and deprivation. The continuing shortage of staff and facilities should supply the stimulus for efficient pooling of resources.

Mr. W. C. Todd, Principal Probation Officer, Middlesex County Probation Service, outlined the necessity for, and difficulty in, providing for early recognition, diagnosis and treatment, as recommended in Part One of the Ingleby Report.

Defining the probation officer's approach, he indicated, from the national crime statistics, the great volume of delinquent and needy children, and directed attention to the even greater proportion which, like the submerged part of the iceberg, were never revealed. While recognising the difficulties imposed upon clinics by excessive case loads, he indicated the probation officer's need for support. He warned against investing psychiatry, on the other hand, with a magic it never claimed. In view of the risks which delinquents bring upon themselves and the community, the clinics should give priority to the delinquent. He inquired as to whether the reluctance of clinics, and their poor results, might be due to the intrinsic nature of the delinquent, to insufficient, unsympathetic or inexperienced psychiatrists, to policy, to the "operational structure of the agency," or to frequent changes of personnel within the clinic.

He advocated diagnostic centres and peripatetic teams to operate in probation officers' premises, and suggested that probation hostels might be located near psychiatric units.

P. D. S.

THE TWELFTH INTERNATIONAL COURSE IN CRIMINOLOGY

The Hebrew University of Jerusalem—September 1962

For three weeks in September 1962, over seventy students and some twenty staff from many different countries took part in the Twelfth International Course in Criminology, held at the Hebrew University of Jerusalem under the auspices of the International Society of Criminology. The theme was "The Causation and Prevention of Crime in Developing Countries." Many students came from former British and French African territories, from the Middle East, from Asia and the Far East, and from South America. Some were senior officials in their own countries, including the Minister of Justice of the Ivory Coast. There was a procession of distinguished visitors, including Professor Sheldon and Mrs. Eleanor Glueck, Professor di Tullio and Dr. Fontanesi (Rome) and Mr. Edward Galway of the U.N. Social Defence Department. M. Jean Pinatel attended throughout the course, as did Professor Walter Reckless (Ohio), Dr. Bruno Cormier (Montreal), Dr. Wolf Middendorff (Freiburg), Mr. J. J. Panakal (Bombay), Dr. T. Asuni (Nigeria), Dr. W. H. Nagel, Dr. H. Bianchi and Father van Rooy (Netherlands), and Mr. J. E. Hall Williams (London).

Lectures and seminars were held each weekday, and at the weekends extended tours were made to visit penal institutions, agricultural settlements and scientific centres, and many historic places. The course ended with a two-day symposium in which various aspects of the crime problem in developing countries were explored by panels of experts in a public session. Many distinguished and knowledgeable Israelis took part in these discussions and in the general deliberations of the course and added greatly to its success. But the main credit for what the writer regarded as an outstanding experience goes to Professor Israel Drapkin, the Director of the Institute of Criminology at the Hebrew University, who, with the help of his indefatigable assistants, undertook the task of organising the course so courageously, a task which he carried out cheerfully despite many difficulties, to the great benefit and enjoyment of all those who came to Jerusalem for this purpose.

J. E. H. W.

NOTES

CRIMINOLOGICAL CONFERENCES IN PARIS AND ROME IN 1962

THE writer spent some time during 1962 on the continent in order to assist with two criminological conferences, each of which can be regarded as constituting important milestones in the gradual construction of an international criminological empire. The first conference was held in Paris under the auspices of UNESCO. Representatives were drawn together from such different disciplines as the law, statistics, psychiatry, education and especially pyschology, and from such different countries as the U.S.A., U.S.S.R., U.A.R., Israel, Poland, Turkey, U.K., France, Western Germany, Chile, Japan and India.

The aim was to assess—with reference to juvenile delinquency and mental health—the multiple research needs of the various countries, in the light of already existing research projects, all as yet totally unco-ordinated and representing different levels of sophistication. As might be expected, after several group-sessions of experts it became clear that the time was considered not yet ripe to draw up specific research programmes for mutual participation with various partnership combinations according to the individual's own interest and capacity. However, progress was made by drawing up broad areas of projected research programmes for future international co-operative efforts. The need for further meetings and UNESCO's increased involvement in this field was established. The writer, who acted as co-ordinating rapporteur, also had the opportunity of establishing closer contact, not only with colleagues from abroad, but in particular with French colleagues and some local institutions, clinics and research centres.

The second conference took place in Rome under the auspices of the Geneva European office of the United Nations, with the aim of evaluating methods used for the prevention of juvenile delinquency in European countries. Some of the following areas were covered: the role of community, of psychiatry, of the school, of vocational guidance, the law, courts, clubs, and the police. Selected experts, representing their different subjects, read specialised papers (with the writer presenting a paper on behalf of UNESCO on the preventive role of the school) and then formed themselves into discussion groups with other experts from different countries and disciplines, including representatives from the World Health Organisation, the Council of Europe and UNESCO. Whilst a great deal of research is being carried out on delinquency generally, there is a dearth on the topic of delinquency prevention programmes. In evaluating such programmes, it is clear that only a beginning has been made in this field in Europe. The Conference was mindful of the need for the ultimate establishment of a research clearing house and kept an eye open to the developments of the 3rd U.N. Congress to be held in Stockholm in 1965.

R. G. A.

CANADIAN CONGRESS OF CORRECTIONS, 1963

The following information has been received from Dr. T. Grygier:

THE next Canadian Congress of Corrections will take place in Winnipeg, Manitoba, June 2–7, 1963. The main focus of the Congress will be on research and staff training. Mr. Alex Edmison and Dr. Maurice Gauthier are co-chairmen of the Programme Committee. The programme will include other topics, but this notice is concerned solely with papers on criminological and correctional research.

Mr. Charles Fine of the Juvenile and Family Court, 311 Jarvis Street, Toronto 2, Ontario, will act as the secretary for the research programme of the Congress, with Dr. T. Grygier of the University of Toronto, as consultant. All correspondence, including requests for information, should be addressed to Mr. Fine.

An invitation is hereby extended to any qualified person wishing to read a scientific paper at the next Congress. Decision whether or not a paper has been accepted will be made and conveyed to the prospective speaker as soon as possible.

Definition

Papers concerned with research might describe:

(a) research recently completed;
(b) research in progress;
(c) programme of research activities at an institution, in a geographical area, or in a field of application;
(d) discussion of needs, strategy, methodology or application of research in criminology and corrections.

As implied by the foregoing, the term "research" in the context of this announcement extends beyond any specific investigations in pursuit of knowledge. It covers also problems of theory and method, and surveys of research activities and of scientific literature. It includes clinical criminology and legal studies, especially in criminal law and jurisprudence. Discussions of legal and psychiatric concepts, the provisions of the criminal law, the administration of justice, and evaluation of treatment techniques, all fall into this broad definition, and papers on such topics will be classified as research papers.

THE END OF THE PRISON COMMISSION

An Editorial Comment

THE abolition of the Prison Commission, after a life span of nearly ninety years, and its absorption by a Prison Department of the Home Office are events which would in normal circumstances require a full-sized article. In a period like ours, with its rapid and radical all-round changes, we are inclined to look at the disappearance of the Commission, whose constitution Sir Lionel Fox once called " something of a curiosity," with regret mixed with a feeling of " wait and see." The pros and cons of the transformation have been widely, and at times heatedly, argued in Parliament and the Press, and they have recently been clearly and dispassionately summarized by Mr. Hugh Klare in the latest issue of the Howard Journal.

The Prison Act of 1877 which brought the Commission into being was the culmination of effort throughout the nineteenth century to introduce uniformity and efficiency into a prison system which had suffered as well as gained by the autonomy of local administration. Looking back over the last eighty-six years of prison history it is still possible to discern defects and weaknesses as well as strengths. Du Cane, who was the first Chairman, was a man of iron will who set about creating a highly efficient bureaucracy at the expense of humanity. In his writings he appears pompous and overbearing, a fault that was to precipitate his own downfall, but the structure created by him has outlived many other Victorian institutions. The instrument of repression which he devised came in later years to be a means whereby enlightened penal practice could be the order of the day, often in advance of what public opinion thought reasonable. The Commissioners, as public figures, have over the last forty years won the respect of penologists through their readiness to accept new ideas and to talk in public.

The Criminal Justice Act of 1961 achieved what was narrowly avoided in 1948, the abolition of the Commission and the transfer of its functions to a Prison Department of the Home Office. It is no doubt difficult entirely to suppress a certain anxiety that the prison administration of England and Wales, with its growing staff, an ever-increasing prison population, and consequent multiplication of institutions, may become even more impersonal, with more red tape than before, but we have no desire to prejudge the issue. Faced with a *fait accompli*, we willingly postpone the *post mortem* and wish the successors the best of luck in their almost superhuman task of modernising the present system. It is our hope that the annual reports of the new Department will be as frank and informative as those of its predecessors.

BOOKS AND PERIODICALS

REVIEWS

JUDICIAL ATTITUDES IN SENTENCING. A study of the factors underlying the sentencing practice of the Criminal Court of Philadelphia. By EDWARD GREEN. Cambridge Studies in Criminology. Vol. XV. [London: Macmillan & Co., Ltd. 1961. viii + 149 pp. (including Index and Appendices). 25s. net.]

SENTENCING IN MAGISTRATES' COURTS. A study in variations of policy. By ROGER HOOD. Introduction by Hermann Mannheim. The Library of Criminology. Vol. 7. [London: Stevens & Sons. 1962. xxiii + 145 pp. (including Index and Appendices). 20s. net.]

THE appearance of two books on sentencing, one in each of the important series of criminological treatises now being published in Britain, is not entirely fortuitous. The attention devoted to this subject of sentencing by the Streatfeild Report shows that nowadays it is recognised that the process of deciding what to do with offenders once they have been convicted is extremely important. This interest in sentencing is both academic and practical, for the study of the subject has far-reaching ramifications in many different directions.

There have been several academic studies going back to the early years of the twentieth century, especially in America. These have been mainly concerned to demonstrate how uneven the different judges or magistrates were in their choice of sentences, even in like cases. But more recently the trend has been towards uncovering the hidden uniformities which go a long way to explain, if not entirely to justify, the variations in sentencing. In any case, it has been pointed out, surely individualisation of punishment (which is supposed to be desirable) inevitably carries with it the consequence that sentences differ widely. The important thing is that these differences should be capable of rational justification and should be tolerated only within a permitted range.

Both the study by Professor Green and that by Dr. Hood seem to confirm that, contrary to our expectations, there is more to be said in favour of the sentence choices made than against them. Professor Green's book is particularly strong in this direction, and possibly somewhat complacent. After demonstrating the weakness of the conclusions reached in many previous studies, in a review which is remarkable for its re-interpretation of their rather biased findings, Professor Green sets out to do somewhat better. Instead of " simplistic interpretations based on fragmentary data " he offers us a most careful and sophisticated study of the sentencing policy of one of the criminal courts in Philadelphia. He is only too aware of the danger of overlooking the norm-setting function of the criminal law, and he sets out in detail the criteria used in practice to determine the nature and severity of sentence. These criteria differ from those formally supplied by the maximum penalty prescribed, and the special penalties available for persistent offenders, and by the formal classification of crimes into grades. It seems that offences are viewed by judges more in terms of certain aspects of the offender/victim relationship: "in essence . . . the standard underlying variation in the severity of the sentences imposed for diverse offences is the degree of violation of personality" (p. 41). Also judges differentiate according to the number of bills of indictment and the quantity and seriousness of the offender's past convictions. "All in all," concludes Professor Green, "the findings reveal a keen sensitivity on the part of the court to differences in the legal make-up of the cases." Although he does not use the phrase, his findings suggest that the "tariff" system of sentencing applies in a reasonable manner in the Philadelphia court studied. The influence of extraneous considerations which suggested themselves in the preliminary investigation, such as biases in favour of youthful and female offenders and against coloured offenders, were shown on intensive analysis to be the result of various differences in the pattern of criminal behaviour by the offenders rather than of hidden prejudices by the judges. Even differences in the apparent severity or leniency of particular judges tended to disappear on full investigation of the circumstances of the cases they decided.

Where the differences were most acute was with the cases which were neither serious nor mild, but within an intermediate range. Here, in the absence of any better guide as to what to do, the judges were freer to indulge their own particular penal philosophies. Once a penitentiary sentence was chosen, however, there was "a surprising degree of uniformity" in the length of the sentence imposed, and it seemed to make very little difference who the prosecutor was or whether the plea was guilty or not guilty. A number of detailed case studies (thirty derived from nine different judges) complete the research. These are analysed in terms of their adherence to or departure from the standards which the author claims to recognise. The analysis of these cases is said to "thoroughly corroborate the results of the statistical analysis." None of the sentences chosen is unduly out of line with the others.

It has been said the study is a complacent one. The author meekly accepts the openly retributive and punitive views expressed by many of the judges, particularly in dealing with grave crimes and persistent offenders. His only suggestion for improvement seems to be that, particularly in the cases in the intermediate range, which are neither mild nor grave, it might help if there were more precise standards for sentencing and more information were available to the courts about convicted defendants. It is reassuring to know that the deliberations of the sentencing judge are not at the mercy of his passions or prejudices, but there is nothing in this study to show that they are well-made decisions as distinct from being rational.

Dr. Roger Hood's study of sentencing in magistrates' courts has a sharper edge to it. Beginning from the remarkable disparity between the imprisonment rate in different magistrates' courts (varying between 3 per cent. and 55 per cent. over the whole country with regard to adult males found guilty of indictable offences in such courts) the author examines the situation in twelve courts chosen from urban areas according to whether their imprisonment rate was high, low or average, and whether they were large or small, industrial or residential, old or new areas. Two samples were taken from the court registers for the years 1951–1954, a sample of property offenders and a small group of cases of indecent assault on young persons under sixteen. The second sample was included as comparative material to see whether magistrates viewed these cases similarly to the property crimes in the first sample.

One of the main difficulties encountered was the extreme paucity of the material in the records in some courts, especially about such matters as marital status, work habits, etc. There is clearly room for improvement in record-keeping if only for the purpose of aiding possible research.

Despite these difficulties, the reasons for the variations in sentence have been more or less fully explored. Dr. Hood sets up a criterion by which to judge the work of the courts, which he calls "equality of consideration." This means that the test is whether they have taken similar factors into consideration in arriving at a decision of a particular kind. It does not mean, as the author is at pains to point out, that the decisions themselves should be the same for all like cases (p. 14). The factors investigated for this purpose include the number of previous convictions, work habits, marital status, occupation, age, seriousness of the offence, the number of offences for which convicted at the trial, and so on.

Judged by this criterion and in relation to these factors, it seems that, while the majority of courts are operating on similar lines, there are inexplicable differences at the extremes. Some courts sentence more men to prison than they ought to, judged by the nature of the offence and the record of the offender. Some courts sentence fewer to prison. Thus " courts in Group A consistently imprisoned far more offenders than could be explained by the types of men appearing before them . . . (and) used imprisonment more frequently for all types of offenders, and not simply for those with bad records. Offenders were imprisoned at these courts who would have received a different sentence at most other courts in the sample. At the other extreme, Railton and Oldchester failed to imprison offenders who would most likely have been imprisoned elsewhere " (p. 119).

Three possible explanations are suggested for these anomalies, (1) the social characteristics of the area served by the court, (2) the social constitution of the bench, (3) the particular approach or attitude of the bench to the crime problem. "The last of these factors may well in general be the most important," says the author, but the other two factors are also frequently contributing. There is some evidence, we are told, in favour of the hypothesis that middle-class magistrates dealing with working-class offenders in relatively small and stable middle-class communities are likely to be relatively severe.

Dr. Hood gives us an interesting reason why this should be so. He says it is possible that the "tough" towns were all so small that the influence of the publication of accounts of the court's doings in the local press was probably much greater (or thought to be greater) than in the large metropolitan communities, which tend to be more disinterested in purely local news, unless it happens to be sensational. Magistrates living in such small towns may well feel able to base their policy more on deterrence than magistrates in the latter kind of place. Dr. Hood suggests that there is room for more research into the way in which judicial decisions in criminal cases are communicated to the public. It is possible that the development of local broadcasting and television could lead to improvements in communication of crime news of this kind to local inhabitants. But whether we want to encourage magistrates to behave as the "tough" town magistrates do, and give further scope to the notion of crime prevention by deterrence and deterrence by severity of punishment, is another matter. It has yet to be demonstrated that the crime rate is improved by resort to such methods.

That there is room for improvement in sentencing is clearly Dr. Hood's message, if not that of Professor Green. If we desire to approach nearer to that equality of consideration, which Dr. Hood thinks inherent in the notion of justice (and I would be inclined to agree with him on this), this can only be done if more is known about offenders, if research about the disparities which occur, of which many courts seem unaware, is communicated to courts, and if Benches themselves become sensitive to the problem and also to the discussion with experts of the penal philosophy which they overtly or covertly adopt and to which they consciously or unconsciously subscribe. For making this abundantly clear we must be extremely grateful to Dr. Hood, and to Dr. Mannheim, under whose guidance this useful piece of research was done.

J. E. H. W.

RECENT LITERATURE ON "WHITE-COLLAR CRIME"

THAT the many issues raised by the late Edward H. Sutherland's various writings on what he called "white-collar crime" are more alive than ever in criminological thinking is brought out clearly in three recent publications.

1. WHITE COLLAR CRIME. By EDWIN H. SUTHERLAND. Foreword by Donald R. Cressey. [New York: Holt, Rinehart and Winston. 1961. xvi+272 pp. English price 16s.]

This new impression of Sutherland's principal work on the subject, first published in 1949 and apparently out of print for some time, is greatly to be welcomed. Its usefulness is enhanced by a brief but thoughtful Foreword by one of Sutherland's best-known students and collaborators, Donald R. Cressey, which not only provides a critical survey of some of the post-1949 American literature but also frankly admits certain weaknesses in Sutherland's own writings on the subject. It is gratifying to see that Cressey is more willing than his master ever was to concede that there can be no single theory of crime causation which would explain all conceivable forms of criminal behaviour and that Sutherland's discoveries in the field of white-collar crime, original and illuminating as they were, do not necessarily mean the death knell of all previously held beliefs concerning the causation of entirely different forms of crime. Among the various other points, not mentioned by Cressey, where Sutherland's writings on the subject are open to criticism is his misleading use of the term "white collar": together with some of his case material, it creates the impression that the term is here employed in its usual sense, *i.e.*, as referring to crime committed by persons not belonging to the working classes, such as clerical workers or shop assistants, whereas it had been Sutherland's primary intention to examine the criminality of the big corporation and its leading representatives, *i.e.*, of persons far higher up on the social and economic ladder. Clearly, a new terminology is needed which would sharply distinguish between different forms of the criminality of the various social classes.

2. TOWARD A DELINEATION OF WHITE-COLLAR OFFENSES. By GILBERT GEIS. [In *Sociological Inquiry*. Vol. XXXII, Spring 1962, No. 2, pp. 160–171.]

In spite of its shortness, this article—together with the corresponding chapter in Bloch and Geis, *Man, Crime and Society* (to be reviewed in one of our forthcoming issues)—is one of the most stimulating recent contributions to the problem. Geis argues that his theoretical preconceptions led Sutherland into a number of "intellectual traps which rendered the conception of white collar crime, as it presently stands, of dubious utility for the study of criminal behavior." In his view, the concept is too vague and all-embracing and should be restricted to "corporate violations of a reasonably homogeneous nature and to cognate criminal acts." In this connection he offers an interesting analysis of the recent Philadelphia electrical equipment trials, probably the biggest and most important anti-trust law violation trials so far held under the Sherman Act of 1890. However, while admitting the need for a clearer definition of the concept "white collar crime," on the one hand, and the important place occupied by monopoly offences in this field, on the other, one might well doubt the advisability of altogether limiting the whole concept to such cases. In Britain in particular, where no criminal legislation comparable to the Sherman Act exists, one has to look elsewhere for important cases of white-collar crime.

3. STRAFRECHTSPFLEGE UND STRAFRECHTSREFORM. [Wiesbaden: Bundeskriminalamt, 1961.]

This important publication of the West German Bundeskriminalamt, Wiesbaden, contains a large number of contributions, mainly by German lawyers and police-experts, on questions concerning the reform of the German Criminal Code and the position of the criminal police. Space forbids a review of the whole volume. By far the longest section in the symposium is the outstanding article by Ministerialrat Dr. Terstegen on white-collar crime. The author is not only thoroughly familiar with the whole Anglo-American and German literature on the subject and its many ramifications, but also makes valuable contributions of his own based on an intimate first-hand knowledge of the various forms of "Weisse-Kragen Kriminalität" to be found in West Germany. His final conclusions are remarkably realistic and pessimistic: neither for the present nor in the near future can, he thinks, an effective defence against this evil be expected. Those responsible for the legislation and the practical measures against it are ignorant of its actual characteristics and of its dangerousness, and the same applies to public opinion.

H. M.

FAMILY ENVIRONMENT AND DELINQUENCY. By SHELDON and ELEANOR GLUECK. [London: Routledge and Kegan Paul. 1962. 328 pp. 35s.]

SINCE the publication, in 1950, of the Glueck's epoch-making study *Unraveling Juvenile Delinquency*, they have undertaken a more complex analysis of the same data. The first fruit of this was *Physique and Delinquency*, in which they sought to determine, in more detail, the extent to which physique-related, constitutional factors played a part in causing delinquent behaviour. The present volume takes this long-term research project a stage further, by exploring the role of what the Gluecks call the "under-the-roof culture," the family lives of delinquents. The book which has resulted is hardly gripping, and often exasperating, but obviously of the greatest scientific importance.

The authors of this book are frank exponents of the multiple factor approach in criminology; that is to say they tend to be sparing with theory, but seek instead to find out what factors tend to be associated with delinquency. Inevitably the factors thus isolated proved to be numerous. All of them may be related to each other in a variety of ways, and then be combined with the constitutional factors studied earlier to form even more comprehensive groupings. Much methodological ingenuity will clearly be called for if a way is to be found through all this. The Gluecks promise a further work, in which the search for these causal "*gestalts*" can be carried further. Meanwhile they have cleared some of the ground.

Thus some delinquency-producing traits are said to be constitutional in origin, the "under-the-roof culture" having apparently no relevance, some to be mainly constitutional, with a contribution from the family environment, and others to be more equally poised between the two. Finally, a group of traits have been studied which appear to derive more exclusively from the delinquents' family setting. These are only the most elementary combinations, however; the analysis could not be left there. The Gluecks have gone a stage further in considering the effect of familial factors on boys possessing particular personal traits (whether constitutional or acquired). They have found that many factors within the family have just a selective effect: the traits seem to act as catalysts bringing to life their criminogenic influence.

The present reviewer has no doubt at all about the necessity for grass-roots research, starting from the facts themselves and seeking genuine empirical uniformities as a basis for theory. To recognise its worth one has only to compare this approach with that of some recent sociological writers. The latter erect pretentious and highly speculative superstructures of theory, contradicting each other, and supported by a minimum of ascertained fact. But it is not possible to eschew theory completely.

Certainly the present work has such a guiding hypothesis: that of multiple causation. The selection of a problem for study, or of a particular method of investigation, always implies some kind of theory about what is or is not relevant. The danger is that such assumptions may not always be explicitly recognised by the researcher, and as a result the qualifications which ought to be placed upon his conclusions are left out of account. There seems in this book, for instance, to be a clear bias towards the constitutional rather than the environmental explanation which evinces itself in various ways:

(a) If neither constitutional factors nor the particular familial factors examined here show any association with delinquency, it is frequently assumed that the cause must be mainly constitutional.

(b) If only one of the familial factors studied is found to be connected with a particular delinquency-producing trait, it is not counted. It does not seem to matter how important, in the light of earlier research, some such factors may appear to be as compared with others; all are treated on a simple additive basis, as of equal significance in the causal nexus. This leaves the field open to a constitutional explanation of the origin of the trait in question —even if no empirical association of this kind has showed itself at all.

(c) Sometimes, where an association is found between a trait relevant to delinquency and factors within the family environment, it is argued by the authors that the trait has probably led to the family problem, rather than the family problem to the trait. This, of course, has the effect of putting the onus back on the constitution again, whether there are any positive correlations at all between the trait and the constitutionally-orientated criteria of physique used here. Sometimes this reversal of cause and effects seems common sense, but sometimes appears less so. Of twenty-eight traits claimed in this book to be constitutional or probably constitutional, no fewer than fifteen are labelled in this way as a result of adopting the procedures described in this and the preceding paragraph.

There is enough here to make it clear that ideas are implicit in this book which would be better if fully acknowledged in a properly worked out theoretical framework. Other implicit assumptions seem to be derived from pyscho-analysis. Professor and Mrs. Glueck often make statements, such as that " compulsory trends reflect rather mechanical attempts to defend the self against conscious or, more often, unconscious anxiety," without citing any evidence in their support either from this or any other study. If facts like this are already so well-established, one wonders why this expensive and very laborious study was necessary at all. It is illustrative of the difficulties into which one gets when assumptions of this kind are not made explicit and carefully defined, that the results inferred from the empirical data in this book often seem to be at variance with well-established components of that psycho-analytic approach which is elsewhere so readily espoused. Thus emotional conflicts, and fear of failure and defeat, are both described here as innate, but much of the clinical literature has been devoted to showing how traits of this kind emerge as a result of the experiences of early infancy.

To many experienced clinicians these and other results from this study will seem very odd. It seems a great pity that the Gluecks, with their great interest in criminal psychiatry, did not have earlier work of this kind clearly in mind when they designed their research. They might then have produced data which illuminated some of the many unsettled issues in this area. Criminological progress must depend upon the sifting of facts, but without explicit theory research is in danger of becoming mere blind groping. The Gluecks have presented us, here, with a mass of facts which it is very difficult to use to elucidate the more important current controversies.

Howard Jones

JUVENILE JUSTICE. By O. NYQUIST. Cambridge Studies in Criminology, No. XII. [London: Macmillan. 1960. pp. xv+302. 50s.]

DR. NYQUIST's book is primarily a comparison of the Swedish and Californian legislation dealing with juvenile offenders and other children whose circumstances seem to call for official intervention. At the same time it surveys in less detail other European codes, including that of England.

Since the Californian code was substantially amended as the result of a Governor's Commission soon after the book's publication, its principal value lies in its survey of European codes and its detailed exposition of the principles and history of the Swedish system of Child Welfare Boards. The student who wishes, for example, to compare the ages of criminal responsibility under modern systems—or even under early Chinese or Icelandic law—will find the summary on pages 115–25 most useful, although the absence of an index will not assist him in tracing it.

As the word " justice " suggests, the author is a lawyer, and the book is very much a lawyer's book. It devotes most of its pages to consideration of the jurisdiction, procedure, and composition of the "competent authorities" who dispose of juvenile cases, and very little to the consequences of the measures at their disposal. For example, what does the "protective upbringing" which a Swedish Child Welfare Board can impose mean in practice? All we are told is that "the ward shall be placed in a juvenile welfare school (institution), but may also be placed in a private boarding home, in a children's home, in a vocational home or in any other institution" (p. 86). With some difficulty we unearth from pages 213–15 a not very clear summary of statistics about the ages and types of conduct of children who are dealt with in this way. But how long can they be kept there, and how long are they usually kept there? What are these different institutions like? Who dictates their regimes? What protects the child against abuse? What rights has the child or his parent? These are questions in which even lawyers are interested, and the photograph of an indoor model of Roxtuna centre for young *adult* offenders is not a complete answer.

Dr. Nyquist illustrates—though he can hardly be blamed for—our preoccupation with formal issues to an extent which distracts us from what we are doing in practice.* The recent debates of the House of Lords over the age of criminal responsibility in England showed the same tendency. When we are seeking to apply compulsory measures to persons under the age of 17 we have a choice between two procedures—criminal and "social." The younger the child is, the less difference there is between the measures which can be applied under one procedure or the other (some of the minor clauses in the Bill reduce the differences still further). For historical reasons—chiefly because the penalties under criminal procedure were fixed and terrible—we exempt children under a certain age from it, but allow them to be dealt with under social procedure. Because the same juvenile courts act under both procedures, the stigma of each is hardly distinguishable. The only important difference is that the social procedure can be applied only to children from unsatisfactory homes. Thus a child from a good home who begins to steal before his eighth birthday cannot be dealt with until he is eight, however mild the measures which the courts apply. The position is illogical, and the Ingleby Committee recommended a procedure under which a child of any age below 12 could be dealt with either because its home was unsatisfactory or because it had committed what in the case of an older person would be an offence. In effect, this very sensibly abolished the minimum age for criminal responsibility, although it was misrepresented as raising it. There is a great deal of evidence to suggest that children form—or fail to form—law-abiding attitudes well before the age of eight; and if they are failing to form them under parental guidance official intervention seems logical, especially if it takes such mild forms as an occasional visit by a police juvenile liaison officer, a conditional discharge, or supervision by a child care or probation officer. If juvenile courts are prepared to adopt a wider definition of the circumstances in which social procedure can be applied—and section 2 of the Bill gives them a slight encouragement to do so—the raising of the minimum age for criminal procedure may make little difference. But if the net result is that the same sort of children are to appear in the same sort of courts for the same sort of behaviour, the House of Lords should not over-estimate the significance of its achievement. *Mutatis mutandis*, the issue is the same in every country whose system Dr. Nyquist summarises. What sort of cases can and cannot be dealt with at different ages? What happens in the U.S.S.R. to children under 14 who persistently steal? These are the important questions.

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* On this see also the Note on "The Age of Criminal Responsibility" on p. 388 of this number. [Ed.]

There is no doubt, however, about the need for a work of reference in the field which Dr. Nyquist's book has covered. As such, it is what reviewers call a "mine of useful information." Admittedly, the purpose of a mine is the extraction of material, a purpose for which this mine does not seem to have been designed. The logic of the order of sections is not obvious; there are strange alternations between different sizes of type-face; and there is no index. But for those who can find it the book contains a great deal that is of value.

Nigel Walker

UNDERSTANDING JUVENILE DELINQUENCY. By LEE R. STEINER. [New York: Chilton Co.; London: Mayflower Publishing Co. 1960. 199 pp. $3.95, 32s.]

THIS book—described on the cover as " brutally frank and hard-hitting "—comprises a series of discussions by a woman psychologist on varieties of delinquents and varieties of causes of delinquency presented as a series of case histories with much reported conversation. The presentation sounds like a series of radio talks (in fact, the first chapter is a reproduction of a " University of the Air " radio discussion on " Can we prevent delinquency? "). There is a great deal of criticism—of police, magistrates, parents, the general public and even her own fraternity—and examples of how situations have been wrongly handled. The book is very easy to read and the author makes some shrewd observations.

T. C. N. Gibbens

PROBATION. By J. J. PANAKAL and K. G. DIGHE. Tata Institute of Social Sciences, Bombay. 1961. pp. 24. (Reprinted from the *Indian Journal of Social Work*, Vol. XXII, No. 2, September 1961.)

THIS is a summarised report of a number of contributions to a seminar on probation organised by the Department of Criminology, Juvenile Delinquency and Correctional Administration, and held in Bombay from December 21–23. 1958. Membership included representatives from various government departments, universities, and private welfare agencies. A national probation system is of comparatively recent origin in India, the most important piece of legislation being the Probation of Offenders Act, 1958. In a short report of this kind it was not possible for the authors to make more than passing reference to the most important points made by the numerous speakers. The papers given covered such aspects as "The Scope of Probation in Correctional Work," "The Development of Probation," "The Courts and the Use of Probation," "The Application of Probation Law," "Training," "Administration," and "Problems of the Pre-Sentence Investigation." Readers in this country may be particularly interested in Mahmood Bin Muhammad's discussion of the relationship between the police and probation services. In sum, this is an illuminating account of the difficulties involved in developing a probation service in a country faced with a current lack of community resources. It is pleasant to note the special acknowledgments made to the early pioneering efforts of the police court missionaries in this country.

Herschel Prins

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